This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

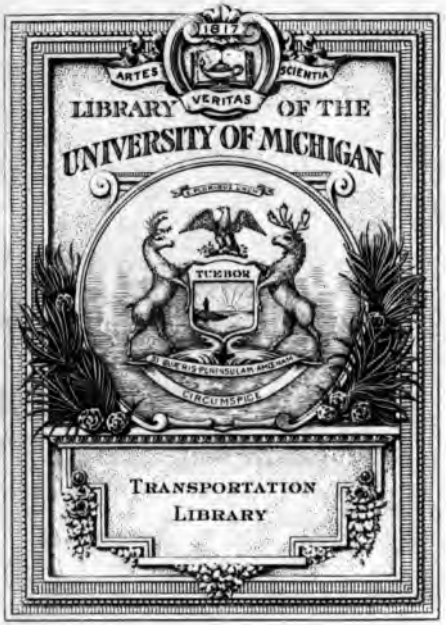
Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

A 761,348

THE RAILWAY GOODS STATION

FRED. W. WEST

Digitized by Google



Digitized by Google

Library
TF
652
.W5

FROM
THE RAILWAY AND
ENGINEERING REVIEW,
537 SO. DEARBORN ST. CHICAGO

Digitized by Google

Digitized by Google

THE
RAILWAY GOODS STATION

Digitized by Google

Loading a Battleship's Masts. [*Frontispiece*

Two battleship's steel masts from Chatham Dockyard (S.E. & C.R.) respectively measuring 114 and 119 feet in length. Weight 43 tons. Each loaded upon eight twin timber trucks, and resting upon the second leading and second trailing trucks.

Digitized by Google

THE RAILWAY GOODS STATION

A Guide to its Control and Operation

BY

FRED. W. WEST
LONDON DISTRICT GOODS SUPERINTENDENT
SOUTH EASTERN AND CHATHAM RAILWAY
(FORMERLY GOODS AGENT TO THE LONDON AND NORTH WESTERN RAILWAY AT LONDON, MANCHESTER, OLDHAM, AND CREWE)

Dedicated to FRANCIS H. DENT, Esq.,
General Manager, S.E. & C.Ry.

London
E. & F. N. SPON, LTD., 57 HAYMARKET
New York
SPON & CHAMBERLAIN, 123 LIBERTY STREET
1912

Digitized by Google

Digitized by Google

CONTENTS

	PAGE
List of Illustrations	ix
Dedication	xi
Introduction	xiii

CHAPTER I

Station Construction	1
Different Organisations necessary to suit Different Places	1
Suggestions for Improvements	3
Arrangement of Outside Staff	4
Productive and Non-Productive Forces	5
Ganging of Men	6

CHAPTER II

The "Bonus" and "Piecework" Systems	12
Duties of Foremen	15
Duties of Inspectors	17

CHAPTER III

Organisation of Miscellaneous Staff	20
Arrangement of "Shifts"	23
Instructions as to Duties of Staff	26
Directions to Checkers	26

CHAPTER IV

Suggested Instructions to Loaders	28
Framing and Issuing Instructions to Workmen	39

CHAPTER V

Indoor Staff	40
Importance of Good Invoicing and Delivery Clerks	40

Digitized by Google

PAGE

OUTSTANDINGS: THEIR CAUSES AND MEANS OF PREVENTION 43
TRAINING FOR ACCOUNT CLERKS 47

CHAPTER VI

CORRESPONDENCE 48
METHODS OF DIVISION 48
THE "CARBON" SYSTEM AND USE OF RUBBER STAMPS. 49
PUBLIC LETTERS 50
CONTROLLER'S PERSONAL CORRESPONDENCE . . 51

CHAPTER VII

CONTROLLER'S SUPERVISION 53
VALUE OF DELEGATION OF MINOR THINGS . . 53
DAILY STATEMENTS AND REPORTS REQUIRED, AND HOW TO DEAL WITH THEM 54
ASSISTANT CONTROLLER AT LARGE STATIONS . . 61

CHAPTER VIII

CONTROLLER'S PERSONAL DEALINGS WITH STAFF . 63
PUNISHMENTS 66

CHAPTER IX

DAILY INSPECTION OF STATION 69
SHORTCOMINGS TO BE FOUND 69
AVERAGE LOADING OF WAGONS 71
ECONOMY OF FULLY LOADING TRAINS 71
RETURN OF DAILY LOADING OF WAGONS NECESSARY . 72
CONTROLLER'S PERSONAL CRITICISM OF LOADING . 73
SOME SUGGESTED RULES FOR PREVENTION OF ACCIDENTS TO STAFF AND OTHERS 73
REPORTS OF ACCIDENTS 75

CHAPTER X

DUTIES OF STAFF OFFICE 76
SELECTION OF STAFF 77

Digitized by Google

PAGE
ADVANCES OF PAY AND PROMOTION . . . 78
COST OF STAFF 79
OBJECT-LESSON OF CONTROLLER TO THE STAFF . . 84

CHAPTER XI

DIFFICULTIES OF WORKING THROUGH WANT OF ROOM . 85
ECONOMY OF SUFFICIENT ACCOMMODATION . . 86
SUGGESTED IDEAS FOR NEW STATIONS . . . 88
DIFFERENT METHODS OF CHECKING GOODS . . 90
SUGGESTED ABOLITION OF INTERMEDIATE CHECK . 91

CHAPTER XII

USELESSNESS OF CHECKING GOODS FROM TRUCK . . 96
ALTERNATIVE SYSTEM SUGGESTED 97
INVOICING 97
ECONOMY OF INVOICING BY TYPEWRITER OVER CARBON PAPER 98
ADVANTAGES OF SINGLE-ENTRY DELIVERY SHEET SYSTEM 99
ECONOMY OF THE ADDING MACHINE . . . 102
DISTRIBUTION OF GOODS BY NUMBERS INSTEAD OF NAMES OF STATIONS—SCHEME EXPLAINED . . 102

CHAPTER XIII

RETURNED EMPTY PACKAGES 106
SUGGESTED ISOLATION AND ARRANGEMENTS . . 106
CHECK UPON EMPTIES RECEIVED 108
IMPORTANCE OF REMARKING DAMAGES . . . 110
GOODS SENT UNADDRESSED: HOW TO DEAL WITH THEM 110
LABELS FOR UNADDRESSED GOODS 114
UNDERCHARGING WEIGHT OF GOODS—TESTS ADVISED . 115

CHAPTER XIV

SMALL STATIONS 118
STATIONMASTERS' RESPONSIBILITIES . . . 119
GOODS TRAFFIC AS A DIVIDEND EARNER . . . 120
DELEGATION OF CLERICAL WORK 120
SUGGESTED RULES OF CONTROL 122

Digitized by Google

CHAPTER XV

PAGE

LIVE STOCK—IMPORTANCE OF OBSERVING REGULATIONS OF BOARD OF AGRICULTURE 125
CLEANSING AND DISINFECTING TRUCKS AND PENS . 126
CRUELTY TO ANIMALS 127
FEEDING AND WATERING 127

CHAPTER XVI

CARTAGE 129
BONUS SYSTEM FOR CARMEN 129
FACILITATING LOADING AND UNLOADING OF VANS . 131
ISSUE OF DELIVERY SHEETS AND BILLS . . . 132
TURNING OUT CLEAN TEAMS 134
SELECTION OF CARMEN 135

CHAPTER XVII

STATISTICS 138
SUGGESTED RETURNS FOR WATCHING EXPENDITURE IN RELATION TO INCOME 139
OTHER USEFUL RETURNS 142

CHAPTER XVIII

FIRE—SUGGESTED BRIGADES—CAUSES AND PREVENTION OF FIRES 143

CHAPTER XIX

FIRST AID—VALUE OF QUALIFIED AMBULANCE MEN . 150
POSSIBILITY OF CONTROLLER INDUCING MORE ENTHUSIASM 151

CHAPTER XX

TRANSHIPPING—THE CREWE SYSTEM EXPLAINED . 153

APPENDIX

THE SUGGESTED GOODS RAILWAY CLEARING HOUSE . 181

INDEX 187

Digitized by Google

ILLUSTRATIONS

FIG.		PAGE
	LOADING OF BATTLESHIP'S MASTS . .	*Frontispiece.*
1.	SIDE VIEW OF A LOAD OF HAY, SHOWING THE METHOD OF ROPING	8
2.	END VIEW OF THE SAME LOAD . . .	9
3.	ALTERNATIVE METHOD OF ROPING A LOAD OF HAY	21
4.	ROPING A FURNITURE VAN ON WHEELS OVER ALL .	32
5.	TYING THE WHEELS OF THE SAME VAN . .	33
6.	ROPING A PAPER VAN ON WHEELS . . .	41
7.	CHAINING A TRUCK OF DEALS. . . .	57
8.	SIDE VIEW OF A LOAD OF HOPS . . .	64
9.	END VIEW OF THE SAME LOAD . . .	65
10.	SIDE VIEW OF A LOAD OF WASTE-PAPER PARCELS .	80
11.	END VIEW OF THE SAME LOAD . . .	81
12.	SIDE VIEW OF THE FIRST PART OF A LOAD OF SUNDRY GOODS	92
13.	END VIEW OF THE SAME LOAD . . .	93
14.	COMPLETION OF THE SAME LOAD (SIDE VIEW) .	100
15.	END VIEW OF THE SAME LOAD . . .	101
16.	CREWE TRANSHIP SHED	113
17.	UNLOADING THE "YORKSHIRE" AT CREWE . .	121
18.	LOADING THE MIDDAY "SCOTCH" AT CREWE .	132
19.	PLAN OF CREWE TRANSHIP SHED . . .	141
20.	A PARTLY LOADED TRUCK OF MISCELLANEOUS GOODS	144
21.	THE SAME LOAD GROWING	145
22.	THE SAME LOAD COMPLETED	148

Digitized by Google

Digitized by Google

DEDICATION

To FRANCIS H. DENT, Esq.,

General Manager,

South-Eastern and Chatham Railway.

Dear Sir,—In acknowledging my thanks for your permission to dedicate this little work to you, I should like to ask for your kind indulgence, and also that of my readers, for the many defects I am afraid it possesses.

To essay " a guide to the control and operations of a railway goods station " is neither a slight nor a modest undertaking, and while writing I have been many times painfully conscious of the familiar metaphor concerning " fools " and " angels."

But on such occasions I consoled myself with the reflection that, in these days of advancing railway science, *somebody* ought to attempt it, and that if I, for one, were to do so, others, more capable, might be induced to follow on.

With that feeling, I continued to the point where I have left off; and in now launching the result among contemporary railway literature, I

Digitized by Google

can only express the hope that it will be received with as much interest as I have had in contributing it.

Yours faithfully,

FRED. W. WEST.

LONDON, *June* 1912.

Digitized by Google

INTRODUCTION

THE object of this work is to attempt to supply what I have for long felt to be a much-needed want—some information and suggestions on the main principles of organising and regulating a goods station.

There are railway books in abundance, dealing with the subjects of train-running, signalling, statistics, and other mechanical and scientific matters; but so far as I am aware there are not any that treat the important parts of the inner working of a goods station in such a way as to be of real use to the person responsible for carrying on its operations.

The many complexities and pitfalls of a large station are fully realised only by those persons intimately associated with one, and it frequently passes even their ingenuity to properly cope with them.

More than one good man has been broken by its besetting difficulties, and there are many other good men on the railway systems to-day who would probably follow suit if given the opportunity—the principal reason being, to my

Digitized by Google

mind, that they have nothing to guide them beyond their own past experience, which, however good in itself, is not always sufficient to enable them to satisfactorily deal with what may be an entirely new set of conditions.

Thinking thus, it has occurred to me to draw upon a varied career among goods stations and write of the "things that matter," with a view to helping others who are going, or who may yet have to go, "through the mill"; and if the task should, perchance, tend to further the ideal of raising goods station operations to the highest standard of efficiency, I shall not consider it labour in vain.

I could not attempt to exhaust the subject, because there is too much to be said about it; nor could I even touch upon all the features, as they are too numerous, while many of them are so well known that it would be trivial to do so; but I can—in simple railway phraseology—say something of the big points which form a part of the daily routine of every station, and it is to these that I address myself.

It will be observed that I use the term "Controller" to signify the person in charge of a station, and I may explain that I do so for the sake of simplicity—although, in passing, I would remark it seems to me rather more expressive and appropriate than any of the usual designations. At one station we have the "Station Superintendent"; at another the "Goods Agent"; at

Digitized by Google

a third the "Stationmaster"; at a fourth the "Clerk in Charge"; and at a fifth the "Yard-master"; all meaning practically the same thing; and therefore I have found it convenient to call them all by one name—the "Controller."

F. W. W.

Digitized by Google

Digitized by Google

THE
RAILWAY GOODS STATION

CHAPTER I

STATION CONSTRUCTION. DIFFERENT ORGANISATIONS NECESSARY. SUGGESTIONS FOR IMPROVEMENTS. ARRANGEMENT OF OUTSIDE STAFF. PRODUCTIVE AND NON-PRODUCTIVE FORCES. GANGING OF MEN.

Station Construction.—There are, of course, many degrees of railway goods stations; and as there are no two exactly alike in construction and operations, it would be impossible to lay down such rules of control as would be applicable to every one. But at all of them it is practicable to adopt certain methods of organisation and supervision that are calculated to make for effective control without unnecessary elaboration and waste.

Different Organisations necessary to suit Different Places.—The design of the station necessarily

Digitized by Google

calls for its own particular legislation. Broad Street, L. & N.W.R., and Bricklayers Arms, S.E. & C.R., for example, are both large sundry goods stations and deal with similar traffics, but are so essentially different in construction that the regulations applicable to the one would be impracticable at the other, and *vice versa*.

Broad Street is a two-level station, where the loading and unloading of trucks is performed in a series of arches and sheds on the street level, while the shunting and marshalling of the vehicles is done on the railway level overhead.

All trucks have to be turned on turntables, whether coming in or going out, and all must be raised, or lowered, by lifts between the two levels, which necessitates a considerable expenditure of valuable time as well as money in capstan and lift working.

The work performed in the arches is done under cramped conditions, and therefore must be rapidly got through to avoid congestion, which again means expenditure of money in labour that would not be requisite under different circumstances.

Bricklayers Arms, on the other hand, is a straight one-level station, where the trucks " in " and " out " can be operated without turntables or lifts, and where the goods are dealt with over ample platforms in spacious sheds parallel with the sidings and running lines, which gives it an immense advantage over the former station, both

Digitized by Google

from a practical and economical point of view, and necessitates a much different organisation.

Suggestions for Improvements.—Similar disparities to a greater or lesser extent exist between other large stations, and must be provided for according to the peculiarities of each one; but it should be always borne in mind that railway engineers (with great respect to them) who design stations are not, as a rule, experts in the manipulation of goods traffic, and in many cases leave it possible for the practical and resourceful controller to devise alterations in the construction of a station that would be of considerable benefit.

There are, for instance, cases where, by substituting a curve for a turntable in a siding, time and labour would be saved in the movement of trucks; or, by putting in an additional siding through an unnecessarily wide shed platform, more needed room could be provided for standing trucks for loading or unloading; or, further, where, by extending a "dead end" siding into a "through" road, a circulation of trucks could be obtained and obviate "drawings" and "resettings," which involve expense of time and labour.

Again, cranes are not always of the most economical type, or set in the most suitable positions for the traffic. The engineer has done what he considered best, according to his knowledge of the general requirements of a station; but the station controller should see things that

Digitized by Google

the engineer has no opportunity of seeing, and might be able to advise changes that would be advantageous.

In the matter of movement of trucks about the station, too, the engineer may not have seen it to be requisite to provide mechanical power for the operations between the engine and the place of loading and unloading, and consequently horses may be employed to do the intermediate shunting; but in the majority of such cases it would be more economical and effective to substitute capstan power, and this possibility should be carefully thought out.

It is a very general rule for the person in charge of a station to accept things as they are, and plod along in a constant fight with difficulties of working that might be removed by some comparatively slight alteration of the kind mentioned; but the live man will be on the look-out for such things, because they are some of the "things that matter."

Arrangement of Outside Staff.—Whatever the station structurally may be like, the arrangement and discipline of the staff are the real basis of organisation, and reflect the ability, or otherwise, of the person in charge to control its operations.

Some men seem to think that the greater the staff the better the results; while others, on the contrary, with the idea of combining economy with efficiency, go in for cutting down to the

Digitized by Google

point of starvation ; but neither extreme is good policy, as either too much or too little is achieved, and the station is the worse for it.

The aim of the successful organiser should be to balance the staff with the work from day to day, and, while allowing a reasonable margin for contingencies, to have no more of the former than the latter will keep fully going, and, on the other hand, not to allow the work to get behind for the want of staff to deal with it promptly.

Productive and Non-Productive Forces.—In laying down the general lines upon which this can be done, and dealing with a large station, the staff may be considered to be divided into two forces—the productive and the non-productive: the first being the men engaged in loading, sheeting, trucking, unsheeting, and unloading; and the second those employed upon miscellaneous duties, such as warehousemen, shunters, number-takers, etc., and who are usually a fixed and regular quantity, no matter how the traffic ebbs and flows.

The productive staff, being the force needing variation as to number from time to time to suit the requirements of a fluctuating traffic, should be composed partly of appointed, partly of supplementary or non-appointed, and partly of casual hands, and should be subdivided into " outwards " and " inwards " forces —the former, of course, to deal with outward-bound traffic, which moves from about midday

Digitized by Google

to midnight, and the latter with the arrivals, which come in during the other twelve hours.

Next, the men on both sides must be ganged —that is, made up into working units.

Ganging of Men.—Upon correct ganging very largely depends the efficiency and economy of a station, and yet it is not too much to say that there is more diversity of opinion among responsible officials as to what *is* correct, than upon any other vital part of operative organisation.

The question is, how many men should there be in a gang? Take unloading. The checker—or the leading hand—is indispensable, as is also his assistant the caller-off; but what number of truckers do they require to carry on the work without the one either delaying or over-running the other?

In practice we find at one station two, at another three, and at a third four, or even five, truckers ganged with the leading hands, and at every one of the places you would probably be told that the formation in vogue was right, although there might not be any practical difference between the work of one station and that of the others.

The explanation is that the foremen responsible for the ganging at the different places have different ideas on the subject, and—without looking at it scientifically—each believes himself to be right and all the others to be wrong.

Digitized by Google

As a general principle, the number of truckers required depends upon the distance to be covered between the points of unloading and delivery of the goods, and it naturally follows that, the greater the ground, the more men there should be. At a small roadside station where the goods merely have to be taken across a platform about 30 feet wide, two truckers would be ample; but at a large station where the average distance to be traversed might be 150 feet, four men would be more economical than three; and in certain cases, where the gangways along the platforms are narrow or are partly obstructed, five would be still more economical.

The way to look at it is that the higher-waged leading hands should not be allowed to slow down or come to a stand in their part of the work through waiting for truckers, who are comparatively cheap; and the best method of forming a correct conclusion as to the actual requirements is to experiment, by seeing how many truckers can keep the checker and caller-off going at full speed without having to wait for their loads.

In the unloading of wagons, a turner-out greatly accelerates the work, especially where the service of truckers is good, and he is equally useful in the unloading of carts and vans, where it is not a recognised part of the duty of a carman to unload his own vehicle.

For the average large station, therefore, it will

Digitized by Google

FIG. 1.—Side View of a Load of Hay, showing Roping.

Digitized by Google

FIG. 2.—End View of the Load of Hay shown in Fig. 1.

Digitized by Google

be found that the best results can be obtained from a gang consisting of a checker, a caller-off, a turner-out, and four truckers.

Whatever may be the number of men determined upon, not more than about one-half should be appointed staff, the remainder being "extras" or "casuals," in order to allow for immediate reductions when a falling-off in the traffic occurs.

The checker, caller-off, and turner-out being the responsible and skilled members of the gang, should be appointed men; but casual labourers, such as can be obtained in ample numbers in most large towns, make sufficiently good truckers if properly looked after by the platform supervisors, and can be safely employed to form the balance.

The advantage of such an arrangement is that during holiday periods and other slack times casuals can be dispensed with, and the necessary number of gangs can be made up from the appointed staff — a portion of the checkers, callers-off, and turners-out working as truckers to the remainder.

A loading gang does not need much description, because at most it does not usually consist of more than three men, viz. checker, caller-off, and loader. Sometimes, when the goods coming along to be dealt with are getting out of control, or include many heavy packages, it is advisable to assist with a porter, but generally the three men

Digitized by Google

suffice, and all being skilled, they should be appointed.

An exception to this rule occurs where it is not the practice to check the goods as they are loaded, or where the "slipping" system is adopted in lieu of checking. In the former case, only two men are required, and in the latter, two men and a youth, the last-named being wanted to write the slips.

A yard gang is a variable quantity as to number, according to the class of traffic to be dealt with. One load may need five men, and the next only two; and it is a good workable plan to treat the whole of the outside loading and unloading staff as one gang to be split up by the foreman from time to time as required.

Digitized by Google

CHAPTER II

THE "BONUS" AND "PIECEWORK" SYSTEMS. DUTIES OF FOREMEN AND INSPECTORS.

The "Bonus" and "Piecework" Systems.—During late years it has been discovered that, to induce the productive staff to attain the maximum of productiveness, they should be paid by results, either by piecework or bonus; and the system is as good for the men as for their employers.

Certain persons, whose policy seems to be to have all men paid alike irrespective of individual ability and industry, object to the principle on the pretence that it takes too much out of a man, but in experience there is no evidence of this. As a matter of fact, the average working man will not voluntarily do more work than he ought to do; and in any case hard work does him no harm, while the extra pay earned by extra work is calculated to do both himself and his family good.

Piecework, or payment of so much a ton for the goods handled, is a satisfactory arrangement where the traffic is regular and continuous, so that the men may always realise a living minimum

Digitized by Google

wage, and it can be generally applied to yard or full-load traffic; but for the handling of sundry goods the bonus system is usually adopted, and is recommended in preference to piecework.

The payment for piecework is a fixed sum of, say, threepence or fourpence a ton, according to the average class of the traffic; but in some cases varying prices are laid down for the different classes, more being paid for one kind than another, in proportion to the labour involved in handling them. For example, threepence a ton would be a fair rate to pay for grain in sacks, as would be sixpence a ton for hay in trusses, the earnings of the men being about the same in both cases.

Bonus is an allowance of so much a ton for weight handled beyond a fixed minimum, in addition to the ordinary rate of wages.

To arrive at a figure that would be fair alike to the staff and the employer, the weight of goods handled by the men during the slack and busy periods of the past year should be averaged; or, if the particulars have not been recorded in such a way as to afford reliable figures, the current working of three or four gangs might be recorded for a week or two for the purpose, and the results taken, in the first instance, as the average productiveness of a gang, or man, in a given time.

Experiments having shown that, by the influence of bonus allowances varying in amount with the work done, the output has increased on the average by about 20 per cent., it will be

Digitized by Google

reasonable to add to the ordinary working *maximum*, so ascertained, 10 per cent., and take the result as the *minimum* weight to be handled before the workers become entitled to any allowance beyond their wages.

Thus, assuming it has been ascertained that the average output of a gang of five men in a net working week of 60 hours is 240 tons, 264 tons might be taken as the minimum requirement for the wage paid, and bonus be allowed upon the tonnage exceeding this figure.

In some cases a *daily* minimum might be fixed for bonus purposes, but this is not recommended, because it has been found in experience that when the traffic of the day seems likely to come out light, and no bonus is visible, certain gangs relax their efforts and feed the more energetic with as much as possible of the heavy stuff, which unduly inflates the bonus earnings of the latter; whereas, when a *weekly* calculation is made, it is necessary for every gang to work as vigorously at the light as at the heavy traffic day by day, in order to be on the right side at the end of the week.

As to the rate per ton of the bonus—this varies at different places, but from a penny to twopence per man for the weight over the minimum handled by the gang may be safely allowed, as being fair to both sides.

Here it should be remarked that the best method of recording the tonnage for calculating piecework and bonus allowances should be care-

Digitized by Google

fully studied, as there is always some danger of mistakes—not to say collusion between parties—which might lead to systematic overpayments being made.

Where, as is generally the case, the figures can be obtained from the invoices, it is desirable that they should be, if only for the reasons that the weights shown on these documents are those upon which carriage is charged, and that the knowledge by the men that the invoices form the basis of calculation is an incentive to them to see that nothing passes *unentered*.

At whatever point of the station, and no matter by whom, the records are taken, it is important that frequent tests should be applied to their correctness both by counterweighing the goods and checking the invoices to the records. It is also important that all calculations and weight totals should be checked and certified by a responsible clerk before the allowances are paid out.

Duties of Foremen.—Coming next to the question of foremanship, it may be said that good foremanship is essential to good organisation. Among the general community there is only a small percentage of men capable of leading, and in railway staffs there are but few men fit to properly control others, even if they have the ambition to do so, which the majority have not. Porters and callers-off are plentiful, and checkers not very difficult to find; but efficient foremen

Digitized by Google

are a scarce commodity, and when discovered should be made the most of.

Really, they are born young, so to speak. When a man has been a manual worker for many years he frequently becomes so used to being led, without thinking for himself, that he is too mechanical in his ideas to direct and command others. The young man, if he is fairly smart, after two or three years' training has usually learnt sufficient about the work to be able to guide the operations, and is not too far gone in serving to acquire the mental strength of a supervisor. An encouraging eye, therefore, should be kept upon all promising young men as possible understudies to the foremen.

It would be difficult, if not impossible, to define the duties of a foreman, because theoretically he is expected to make his men do everything that is right and prevent them from doing anything that is wrong, and the dangers between these two extremes are so numerous and varied that they could hardly be tabulated.

Nevertheless, there are a few rules that can be usefully followed in the arrangement of foremen, and which may be thus set out, viz.:—

(1) Don't give a foreman too many men to look after. He cannot *properly* control the operations of more than five or six gangs working at the same time.

(2) Make him understand that he is responsible for the safe and careful handling of the goods his men deal with, as well as for the quantity of the output.

(3) Let him keep a daily record of his men's time,

Digitized by Google

and the work performed, in such a way that he may see for himself how one day's performance compares with another, and how he stands in relation to other foremen.

(4) Impress him with the necessity of being at his post five minutes before the men.

(5) Require him to promptly report all irregular occurrences, such as accidents of every kind, damage to goods, wagons, and appliances, misconduct of men, delays from any cause, etc.

(6) Warn him to treat his men with encouraging consideration as well as strict firmness, and to neither use, nor tolerate the use of, bad language.

(7) Tell him that it is quite consistent with his dignity as a foreman and his duty to his employers to be popular with his men.

(8) If he is not in uniform, put him in it, as it heightens his status in the eyes of the men.

Duties of Inspectors.—At stations where it is necessary to employ a number of foremen to cover the different sections of the work, an inspector is required to regulate matters between them.

Loading and unloading foremen cannot be kept going without the co-operation of the shunting or yard foreman, and it should be a part of the inspector's duty to see that one section is not allowed to prejudice another, as it is always liable to do, in the individual effort of each foreman to achieve the best for himself, without regard to the requirements of others.

Another important part of his responsibility should be to prevent waste in men, engine power, wagons, sheets, ropes, and other appliances,

Digitized by Google

horses, stores, light, fuel, and, in short, everything of value about the station.

He should constantly see that the various sections of the station are kept supplied with their work, and where there is a hitch he should take prompt steps to effect a remedy. At the same time he should observe a sharp look-out for idling or slackness on the part of the staff, which occurs more or less everywhere.

When the work is giving out in a certain section, an indifferent foreman does not always advise the inspector, so that the staff may be reduced to suit the occasion. He is rather inclined to stretch it out if he can, for fear, perhaps, that in the reduction he himself may be called upon to take up some less congenial task for the balance of his time. The inspector should be alive to this sort of thing.

Among the inspector's other duties should be those of familiarising himself with the qualifications of the different members of the staff, so as to secure encouragement and due promotion for those deserving of it, and the weeding out of the undesirables; seeing that all men are at their posts to time, and that they perform their work properly; rearranging the forces when necessary to better balance the work; assuring himself that all the staff are provided with, and sufficiently understand, the instructions laid down for their guidance; making arrangements for keeping the sidings, stages, and other working

Digitized by Google

parts clear of obstruction; being prepared to keep the points, turntables, capstans, weighing machines, etc., clear during falling snow; having the fire-extinguishing appliances in a constant state of readiness, including the protection of hydrants and water-taps during frost; and, generally, making the station clean and fit.

Digitized by Google

CHAPTER III

ORGANISATION OF MISCELLANEOUS STAFF. ARRANGEMENT OF "SHIFTS." INSTRUCTIONS AS TO DUTIES. DIRECTIONS TO CHECKERS.

Organisation of Miscellaneous Staff.—In organising the non-productive staff, the principle of placing a man where he is wanted for keeping the productive alive may be adopted. This practically embraces everybody, whether he be a shunter, capstan-worker, shunt horse driver, number-taker, craner, hoistman, warehouseman, timekeeper, or other self-contained worker.

It would be wasteful to allow any loss of time by the productive staff to occur through the want of one or more such hands, even though on occasions the latter might not be fully occupied all their time.

The necessity for these men will quickly manifest itself to the supervising staff, and in the first instance they should only be put on experimentally, and not be appointed until the results are seen to warrant it.

There is no general rule to give bonuses to

Digitized by Google

FIG. 3. – Alternative Method of Roping a Load of Hay.

Digitized by Google

non-productive staffs, although the productive staffs greatly depend upon the smartness of this section for the success of their own efforts; but there is no good reason why such a system should not be introduced, both for the effectiveness of the station and the benefit of the men concerned.

Shunters, capstanmen, number-takers, and others whose duties consist of dealing with wagons, could be given a monetary interest in the output of their work by being allowed bonuses upon the wagons over a prescribed number dealt with in a given time. Thus, if the records show that three shunters dispose of 100 wagons an hour during the busiest hours, and 50 an hour during the slacker ones, those figures might be adopted as the minimum requirements, and a bonus be allowed upon any excess, the amount being divided equally between the three men.

The anticipated effect would be that the shunters would get through their work without waste of time, which would otherwise probably occur, and so assist the productive staff to make quicker progress, to the advantage of everybody —staff, employers, and public.

An economy that would probably result would be that the shunters, being naturally anxious to secure the maximum bonus, would be inclined to reduce their numbers to a minimum per hour, so that each one might get as much as possible

Digitized by Google

of the allowance per wagon; and in this desire they would sometimes discover that two men could do the work for which three had been allotted, and that during certain quiet hours of the day they might be altogether transferred to other duties, which, to them, would mean getting the best out of the shunting bonus.

The same method of interesting the men could be applied to capstan-workers, shunt horse drivers, hoistmen, number-takers, and other wagon manipulators with similar expectations; while warehousemen, craners, and other individual goods workers could be allowed bonus upon tonnage.

Since all men work for money, or kind, it follows that, the greater the opportunity, the more they will avail themselves of it; and since the more work performed in a given time the better it is for the employers, it should need no further argument to show that the extension of the bonus system to every grade of employee would be of mutual benefit. Therefore the go-ahead controller would be well advised to conceive and arrange schemes for the extra payment of all his staff upon the basis of something for something.

Arrangement of "Shifts."—The most suitable method of working the staff should be well considered in the matter of organisation, as successful operations depend much upon its application.

Digitized by Google

It is the commonly approved rule to separate the outwards from the inwards goods by dealing with them in different sheds and by different forces of men, who are brought on duty at suitable times to meet the traffic. This means that the staff for the outwards are on duty from about midday to midnight, and those for the inwards from about midnight to midday—which for practical purposes seems all right, seeing that the traffic the respective forces are called upon to handle passes between the hours named. It will be questionable upon reflection, however, whether that arrangement is really the best.

Does the man who commences duty at midnight and continues until midday get proper rest at home, and if not, can he properly perform his work ?

The man who leaves duty at midnight and does not resume until midday no doubt gets his rest, but he never has an evening at home except on Sundays and holidays.

A man who is always engaged upon the outwards work knows nothing of the inwards, and *vice versa*, and, therefore, never becomes thoroughly efficient, which is a loss to the station and himself.

These points struck me so forcibly some years ago that I tried the experiment of forming the outwards and inwards staffs into two blended forces, and working them alternately from 6 a.m. to 6 p.m. and from 6 p.m. to 6 a.m. (including

Digitized by Google

meal-hours), with the result that, after a few weeks' training, the men acquitted themselves satisfactorily and became a new asset to the station, while the work went on better than before.

Not the least advantages of the change were that it was impossible for anyone to make overtime, and that, instead of having a set of jaded men to deal with the traffic at the busiest times of the morning and evening, a fresh and properly rested force was brought to bear upon it at the moment when it was most needed.

There does not appear to be any good reason why this system could not be adopted at most large stations where the work goes on night and day. If the outwards and inwards forces are not equal in number, they can be balanced by supplementing them as required with casuals at the right times.

It is desirable, when possible, to avoid bringing men on duty at unusual hours. Everyone naturally likes to have his ordinary share of rest and recreation at times when he can reasonably enjoy them, and regard should be had for this fact when fixing his hours. If good workmen are compelled to leave their homes at times when they should be going to bed, or at three or four o'clock in the morning, when they are most inclined to stop there, they are apt to look about for other jobs where the conditions of labour are more convenient, and the best often succeed.

Digitized by Google

Instructions as to Duties of Staff.—To obtain the maximum of efficiency from a staff, they should be clearly instructed in the details of their duties, and the instructions should be given to them in writing or print, so that they may have them for reference.

So far as the bulk of the staff is concerned, the instructions need be only brief and easy to remember, because the duties are obvious; but it is well that they should be explained as well as understood, so that when failure occurs no man can successfully plead that he "didn't know."

Shunters and others engaged in the movement of wagons, needless to say, should be furnished with extracts from the rules and regulations pertaining to their duties contained in the Rule Book, and these should be supplemented by the local orders of the station, which, however, before being issued, should be approved by the management.

Directions to Checkers.—Checkers should be impressed, among other things, with the necessity of not delegating a part of their duty to the callers-off, but of assuring themselves that:

(1) The goods correspond with the consignment note or invoice, and that, in the event of there being a difference in any particular, they should clearly remark it on the face of the document.

(2) The goods are in a fit state to undergo the usual handling in their further progress, and that, if there is a doubt about it, they should call the foreman's attention to them.

Digitized by Google

(3) The goods are safely and economically loaded on the truckers' barrows for movement along the decks.

Callers-off chiefly require instructions to be careful to read to the checkers the *full* names and addresses, or marks, on the goods, and to call attention to any apparent defects in the packages. They should, further, be ordered to load the goods on the truckers' barrows safely and economically, and send two or more men with heavy and highly damageable loads, such as cases of glass, crates of earthenware, large packages of eggs, furniture, etc.

Digitized by Google

CHAPTER IV

SUGGESTED INSTRUCTIONS TO LOADERS. FRAMING AND ISSUING INSTRUCTIONS TO WORKMEN.

Suggested Instructions to Loaders.—Loaders of goods into wagons have many obligations to fulfil, and for their guidance I have drawn up the following set of suggested instructions, which, in phraseology understandable by their class, include the main provisions of the General Merchandise Instruction Book.

First Principles.

Load every wagon *safely*, so that nothing may fall off in transit and perhaps cause an accident.

Do not take any risk of this.

Load it *fully*, to economise stock; save shunting and trouble in getting extra wagons; facilitate marshalling on the train; and quicken the unloading and delivery of the goods at the other end.

Load it *carefully*, to prevent damage to the goods by friction or collision between one article and another while the wagon is moving.

Observe the following rules, viz.:—

(1) Clean the truck before using.

Digitized by Google

(2) Knock down or remove any protruding nails in the floor or sides of the wagon.

(3) Cover the floor with a good layer of straw or other similar packing.

(4) Build the load at the ends first, and finish in the centre of the truck.

(5) Select the heaviest and least damageable articles for the underload.

(6) If the ends of the truck are level, cant or slope the heavier articles therefrom, where practicable, at an easy angle to the under goods, so as to form a cradle for the remainder in the centre of the load (see figs. 12 and 13).

(7) Reserve all light articles liable to be damaged by crushing for the top of the load.

If they have been already placed in the wagon before heavier goods come to hand, raise them up to the top of the load.

(8) Do not load beyond the gauge or marked carrying capacity of the wagon.

(9) When the load is complete, and before sheeting, get a foreman or other responsible official to examine it as to its safety for travelling and security of the goods.

(10) Be careful to rope every load where necessary. If in doubt whether roping is necessary or not, rope it.

(11) Be sure to sheet the load in such a way that the goods may not get damaged by wet or fire, and adopt these precautions, viz. :—

(*a*) Use two or more sheets where necessary to fully cover the load, and arrange the *overlap* towards the *rear* of the train.

(*b*) Use only sound sheets, and examine each one to see that it *is* sound.

Digitized by Google

(*c*) Leave the load over rather than use a bad sheet.
(*d*) Tie down the sheets well, so that they may not be blown out during travel and expose the goods to rain and sparks from engine.
(*e*) Arrange the sheets rick-wise over the top of the load, so as to allow the water quickly to run off.
(*f*) If the load is only a small one, wrap the sheet entirely round it.
(*g*) When using a box truck, sheet it over if there is any doubt that it is watertight.

(12) Be careful to fasten the doors on both sides of covered and drop-side wagons.

(13) Remove old labels and rub out any chalk-marks on the truck.

(14) Affix a label on each side of the wagon, and write the destination and route very distinctly.
Write in ink where practicable.
Arrange the labels so that they will be visible when the truck has been sheeted.

Labelling Wagons containing Perishables.

(15) Affix extra labels on the sides of wagons containing meat, fish, or other perishables to indicate the nature of the perishable contents.

Wagons containing Earthenware, Castings, Glass, Eggs, Cheese, and Fragile Goods.

(16) Distinctively label "fragile goods," as a warning to shunters to shunt them gently.

Packages of Eggs.

(17) Raise into the wagon by hand where practicable, and load flat across the wagon—*not gunshot.*
Do not place any goods on the top of them.

Digitized by Google

Do not " walk " them on their ends, nor up-end them, either on the deck or in the wagon.

Always lower them gently to the ground.

Crates of Earthenware.

(18) Load flat, or on their sides, and never on their ends or faces.

If not full-faced, they may be " topped " crosswise, and also " canted."

Do not load anything on the top of *full-faced* crates.

When lifting by crane, be careful to see that the struts in which the hooks are placed are sound enough to bear the weight.

Glass.

(19) Load gunshot with the address uppermost—*unless labelled to the contrary.*

Place on a level and pack up all round, using ropes if necessary to prevent movement during shunting.

Do not load barrels or rolling articles near them.

Call the attention of the foreman to any " rattling " packages.

It is wrong to place any package on its end or side, either on the deck or in the wagon.

Specially constructed well wagons and floats should be used for conveying large cases of glass, if available.

Furniture.

(20) Place light furniture on the top of the load, and thoroughly pack with straw all projecting parts, such as legs, arms, knobs, feet, castors, etc., so that they may not be scratched or wrenched off by friction while the wagon is travelling.

Covered wagons, if available, should be used for quantities over merely a few articles; and where the furniture is not sufficient to employ a whole vehicle, it should be built up by itself at one end.

Call the attention of the foreman to any apparently broken or defective parts.

Digitized by Google

FIG. 4.—Roping a Furniture Van on Wheels over all.

Digitized by Google

FIG. 5.—Tying the Wheels of a Furniture Van.

Digitized by Google

Jam.

(21) Load cases and boxes of jam flat, with address uppermost, *unless labelled to the contrary.*

If they have no lids, protect the contents by placing larger cases or boxes on the top, provided the latter are not too heavy.

If there is any sign of rattle or damage, call the foreman.

Ale, Porter, etc.

(22) Place cases of ale, porter, lager, mineral waters, and other beverages in such a position that they cannot be readily got at by would-be pilferers.

They should be put as far away as possible from the doors of covered wagons, and when loaded in open trucks be well packed around and over with other goods.

Bale and Truss Goods.

(23) Do not use hooks in craning or handling bales and trusses of soft goods, as they are very liable to do serious damage to the contents.

Protect the packages well with straw against friction with other goods and the sides and ends of the wagons. especially any projecting nuts or bolts.

Contaminating and Offensive Articles.

(24) Do not load any articles, such as oils, paints, fat, skins, poisonous liquids, etc., that may contaminate other goods, anywhere near such articles as tea, sugar, eggs, butter, lard, condensed milk, jam, meal, corn, biscuits, or other commodities intended for human consumption, or that may be damaged thereby.

Fat and Hides.

(25) When fat and wet hides cannot be loaded in separate wagons, a receptacle should be made for them *outside* the sheet at one end of the wagon, so that they may not be in contact with other goods.

Digitized by Google

Casks of Oil, Spirits, and Wine, and Musical Instruments.

(26) Load in spring-buffer wagons. The casks must be placed lengthwise, with bungs uppermost, and tightly scotched with wooden or straw scotches—*not bricks or stones.*

Engines and Machines on Wheels and Fly-wheels.

(27) Thoroughly secure the running wheels by scotches and roping.

Nail down the scotches.

Boilers of Large Dimensions.

(28) When dimensions do not exceed 24 feet, load on a double-bolster truck and bind with two fitted chains.

When loaded on two highway vehicles, two binding chains must be used, one for each truck.

Furniture Vans.

(29) Scotch and thoroughly secure the wheels by roping to the truck ; also rope the under-carriage and *body* lengthwise and crosswise (see figs. 4 and 5).

Nail down the scotches.

Gas Stoves, Ranges, Grates, and Castings.

(30) Lift with rope slings where a crane-hook cannot be securely fixed in a strong part, such as the front bar of a grate.

Place plenty of straw or other packing between the parts when loading in the wagon.

Load upright and gunshot.

Sacks of Grain, Flour, etc.

(31) When laid down in the truck, turn the mouths of the sacks to the *inside* of the load.

Cant the sacks at each end if the shape of the truck permits.

Rope if the load is high above the wagon side.

Digitized by Google

Hay and Straw.

(32) Require careful loading, gauging, and sheeting, two sheets being used, if necessary, to completely cover the load.

Secure roping from end to end and side to side is essential (see figs. 1, 2, and 3).

Long Articles over End of Wagon.

(33) Must be bound with ropes or chains to prevent slipping, and the projecting ends must be towards the rear of the train.

Use a " runner " wagon where necessary to clear the wagon next following.

Articles requiring two Trucks.

(34) Thoroughly bind on the trucks, *and couple the latter tightly together.*

Articles requiring more than two Trucks.

(35) Bind the articles together with ropes or chains, *but do not allow the load to bind the trucks too tightly* so as to prevent the latter from going easily round curves.

Swivel or bolster trucks must be used, and also " runner " wagons if necessary.

Short Pieces of Timber, Sleepers, etc.

(36) Should not be loaded with long timber, but in ordinary trucks, with sides and ends.

Carboys of Vitriol and Corrosive Liquids.

(37) Should be loaded by themselves when practicable; but when placed in the same wagon as other goods, keep them well apart from the latter, and put a good buffer of straw or other packing between them and the next articles, which should be selected from the least damageable, in case a carboy should burst. Empties should be chosen for this purpose.

Digitized by Google

Rope the carboys together, so as to prevent a single one from moving, and put plenty of packing between them and the ends and sides of the wagon.

Cheese.

(38) New or soft cheese must not be "topped" either on the deck or in the wagon.

Place in a single layer on the top of the load, and put straw between one cheese and another.

Hard foreign cheese may be "topped" two or three high.

Sugar, Flour, Tea, Cement, Biscuits.

(39) As these and similar articles are very susceptible to damp, be careful to use only *dry* wagons for them, and always take the precaution of strawing the floor to guard against dirt as well as damp.

Look out for any signs of damp or dirt on the packages, and call the foreman's attention to them.

Hops.

(40) Should be loaded in dry and clean wagons, and built up as shown in figs. 8 and 9.

Secure every load with two sheets, and load up to gauge.

Fruit.

(41) Do not risk crushing for the sake of heavy loading, as it is better to use extra wagons than incur claims for damages.

Affix distinctive labels to the wagon to show the nature of the contents.

Iron Cement Drums.

(42) These should always be loaded on their sides, and in large cattle trucks when possible; 144 can be loaded in a cattle truck.

Motor Cars and Chassis.

(43) When loaded with general goods, select soft packages to protect the wheels and sides.

Digitized by Google

Place pads of straw between rubber wheels and truck, and rope securely to the ends of the truck.

Live Stock in Crates.

(44) When fowls, pigeons, calves, pigs, etc., in crates are loaded with general goods, tie a portion of the sheet back at the corner where the crates are located, to admit the air.

Do not load near them any goods liable to get damaged by the live stock.

Binders.

(45) Load on carriage trucks, and strap the wheels to the wheel bars.

If loaded in open goods truck, scotch the wheels, and nail down the scotches with wire nails.

Lino.

(46) Load flat on the bottom of the truck, and do not place any other heavy goods on top that may flatten the lino. and cause it to crack.

Crates or Bundles of Paper.

(47) These must not be loaded on end. Keep them flat and in tiers within about 6 inches from the sides of the truck, and cant the top layers towards the centre of the load (see figs. 10 and 11).

Use two sheets for covering.

Brewers' Grains.

(48) Select a clean and suitable truck, free from any kind of taint, and well sweep out before using.

Pianos.

(49) Load lengthwise, with a wad of straw or packing between the end of the instrument and the end of the truck.

Cover entirely by sheet to protect it from steam, independently of covering the truck.

Digitized by Google

Lead Piping in Coils.

(50) Load flat on the bottom of the truck, one on top of the other.

On no account must they be up-ended, either in the truck or in the stage.

Gunpowder and other Explosives.

(51) When gunpowder vans are not available, load in ordinary vans and entirely wrap the explosives in a sheet, so that no portion may come in direct contact with the floor, ends, or sides of the van.

Framing and issuing Instructions to Workmen.—In issuing instructions to men it is a very common practice to frame them in the ordinary official phraseology and get them signed for by the parties concerned, but I find this is not sufficient. They should be worded simply, and read over to the men, who should at the same time be examined as to their understanding of them.

It is a good plan to paste the signed copy of each instruction in a book, for ready reference and re-issue from time to time, as new men come into the staff and the old ones become forgetful in the way that they do about most things—except the clock—and their wages!

Digitized by Google

CHAPTER V

INDOOR STAFF. IMPORTANCE OF GOOD INVOICING AND DELIVERY CLERKS. OUTSTANDINGS: THEIR CAUSES AND MEANS OF PREVENTION. TRAINING FOR ACCOUNTS CLERKS.

Indoor Staff. — The indoor or clerical staff, being an essential portion of a station's organisation, requires satisfactorily arranging in order to get the best results from the outside staff.

Importance of Good Invoicing and Delivery Clerks.—Though often considered to be the inferior section of the clerical staff, the invoicing and delivery clerks are undoubtedly the most important; in fact, they are the productive quantity without whom the outside work could not be carried on. There was a time when clerks who were failures, or contumacious, were relegated to the invoice or delivery office as a punishment, and the practice may exist to some extent now; but everyone who properly appreciates the necessity of the staff dealing with the consignment notes, invoices, and delivery documents keeping pace with the man handling the goods,

Digitized by Google

FIG. 6.—Roping a Paper Van on Wheels.

Digitized by Google

and at the same time doing their work accurately, will understand the advisability of selecting only the smartest clerks for the duty.

The consignment notes for the outwards goods, where they are checked at the wagon side, are not available for the invoicers until the goods have been loaded, and then many of the invoices have to be written out and the charges calculated at racehorse speed, so that the documents may go by the last train out to meet the goods at the destination station. If they miss the train, delay more or less serious occurs in the delivery of the goods to the consignees, and complaints, or claims, or both, are very liable to follow.

If mistakes are made in the charges—which are not easy to arrive at from the complicated Classification and Rate Books—there is the liability of loss to the railway by undercharge, or offence to the public by overcharge, and in either case clerical work is created to make the necessary adjustment.

Similar results ensue from inefficiency in the delivery office, and the defects in both offices cause inflation of the correspondence and accounts staffs to deal with the shortcomings.

It will therefore be seen that the proficiency and economy of a station, so far as the indoor work is concerned, depends in the first instance upon the invoicing and delivery offices, and that the staffs should be chosen accordingly.

Digitized by Google

Outstandings: their Causes and Means of Prevention.—The number and quality of the staff of the accounts section largely depend upon the system of accounts initiated by headquarters, and the standard of efficiency of the invoice and delivery offices; but there is one quarter of the office that should be particularly well organised, and that is the outstanding department.

The outstandings reflect the weaknesses of the various sections of the clerical staff, and if each one is thoroughly bottomed and made an object-lesson of, it will go a long way towards improving the general efficiency of the station.

The average outstanding clerk is content to get his outstanding cleared, without taking any effective steps to reduce the chances of a recurrence; but with a proper organisation every kind of failure that leads to the item being outstanding should be clearly exposed and dealt with by the controller of the station, or one of his responsible assistants.

Let us consider the principal causes of outstandings, and the means of preventing them.

1. CHARGES UPON OUTWARDS GOODS BROUGHT IN BY COMPANY'S CARMEN, PAYABLE BY THE CONSIGNORS, AND NOT DULY COLLECTED BY THE COLLECTORS.

The accounts for the items should be made out during the night after the despatch of the invoices, and forthwith entered in the books of the

Digitized by Google

collectors, who should be questioned day by day by the accountant as to the reasons for any delay in obtaining the money.

When an amount is not obtained within a reasonable time, it will be concluded that either the collector has been lax, or the consignor is too long-winded or troublesome, and the case should be reported to the controller, for him to take the needful steps with the one or the other.

2. CHARGES UPON INWARDS GOODS NOT OBTAINED UPON DELIVERY.

Theoretically, there should be no such cases, if the instructions of the directors, usually notified upon the delivery sheets and other documents, are strictly carried out; but, in practice, it sometimes happens that a well-known trader's own carman comes to the station for the goods without the money for the charges, or the trader is too busy to pay the Company's carman when the goods are tendered at his premises, and to avoid inconvenience to him the delivery is made without the charges being collected. In such instances the accounts should be promptly debited to the Collector, and be dealt with as in case No. 1.

3. CHARGES ENTERED ON THE OUTWARDS INVOICE AS "PAID" SHOULD BE "TO PAY."

These errors should be detected on the night they are made, when the consignment notes are checked with the invoices, or the copies of them;

Digitized by Google

and " urgent train telegrams " or wires should, where necessary, be sent to the destination stations to raise the charges on the goods and sanction a debit.

At the same time the names of the invoicers committing the errors should be registered, and a summary showing the number of cases against each individual be periodically submitted to the controller, so that he may take suitable notice of them.

4. UNDERCHARGES UPON OUTWARDS " PAID " ENTRIES.

The same remarks as in case No. 3 will apply.

5. CHARGES UPON INWARDS TRAFFIC ENTERED " TO PAY " IN ERROR, OR OBJECTED TO BY THE CONSIGNEES ON THE GROUNDS THAT THEY SHOULD BE PAID BY THE CONSIGNORS.

The sending stations should be written on the day after the delivery of the goods or the objection has been made, requesting that immediate application be made to the consignor for admission of liability for the debit (unless this already appears on the consignment note), and that a " recharge " be accepted without delay.

The request should be repeated every week, if necessary, until a definite reply has been received.

In some cases the reply will be that the consignor refuses to pay, saying that it was under-

Digitized by Google

stood that the consignee should do so, and the correspondence should then be passed to the collector to make a special application to the latter. If liability is still disputed, the matter should be promptly reported to the controller for pressure to be applied to the apparently liable party, and, if necessary, for the stoppage of further credit.

6. UNDERCHARGES UPON INWARDS "TO PAY" TRAFFIC.

If committed by the sending station, they should be discovered and adjusted by the clerk who checks the charges on the invoice before the delivery entries and accounts are made out. Failing that, or if they occur through error on the part of the entering clerk, the names of the delinquents should be registered and submitted to the controller as in the case of No. 3.

It pays, however, to have the entries from the invoices to the delivery sheets, or books, checked by independent clerks both as to goods and charges, and where this system is adopted outstandings through wrong entering are reduced to a minimum.

7. MISCELLANEOUS DEBITS, SUCH AS RENTS, WHARFAGES, DEMURRAGE, AND SPECIAL CHARGES.

These should be promptly debited to the collectors and dealt with on the lines of No. 1. In

Digitized by Google

many cases they are allowed to drift and unreasonably burden the outstandings through delay in making application for payment.

8. Ledger and Credit Account Deductions.

These comprise items coming under the foregoing headings which are only brought to light after the rendering of the accounts, and in many cases not until payment is applied for.

Sometimes they are not promptly investigated, with the result that their clearance is protracted, and the outstanding books and returns are unduly overweighted. The object should be, therefore, to arrange for all the deductions to be taken in hand day by day as they are notified, and, further, to persuade the firms to give the earliest possible advice of them.

Training for Account Clerks.—It is perhaps hardly necessary to say that the accounts staff should have nothing to do with the handling of cash. They should be the local auditors of the station, and systematically check everybody and everything connected with the passage of money, even to the extent of intermittently visiting persons against whom there are amounts outstanding, to test the *bona-fides* of the items.

The training for accounts clerks should be obtained in the invoice and delivery offices, and juniors should be given to understand that a term in these offices is a necessary qualification for the more desired office.

Digitized by Google

CHAPTER VI

CORRESPONDENCE. METHODS OF DIVISION. THE CARBON SYSTEM. USE OF RUBBER STAMPS. PUBLIC LETTERS. CONTROLLER'S PERSONAL CORRESPONDENCE.

Correspondence.—The ordinary correspondence of the station should, so far as practicable, be concentrated in one office, which should be as near as possible to the book room, where the consignment notes, invoices, delivery sheets, and other documents and books to be referred to, are kept.

Methods of Division.—It is a common system to apportion the work between the clerks according to the nature of the subjects—that is, certain clerks are deputed to deal with one class of subject, and certain others with another, and so on; but I consider it better, for several reasons, to divide it up in station order—that is, to allot to each group of clerks all matters concerning certain stations, taken alphabetically, irrespective of subject.

The particular advantage of this arrangement is, that the clerks become familiar with the

Digitized by Google

peculiarities of the stations they deal with, and are thus enabled, in many cases, to explain straight away to complaining public—and others—occurrences which, without such familiarity, would lead to correspondence. It further tends to bring more forcibly to light any chronic bad working on the part of those stations, the home staff, and the train services, which are matters for the controller to take in hand.

An exception should, however, be made in the case of "not to hands" and "unentereds," both of which should be dealt with by the same clerk, or group of clerks, so that the "not to hand" of one station may be reconciled, if possible, with the "unentered" of another.

The "Carbon" System and Use of Rubber Stamps.—Much economy can be brought about in the correspondence office by the adoption of the carbon system of taking copies of the letters, where the practice does not already exist. The use of rubber stamps for stereotyped replies is also a time and labour saving system. An examination of the correspondence will show that a great many letters are regularly written with the same or similar wording, and a series of stamps, lettered to express the communications, can be conveniently adopted for them.

The different stamps should be numbered consecutively, and all the referencer has to do, after making the necessary inquiries, is to mark on the papers "No. so-and-so," to indicate the kind

Digitized by Google

of stamp reply that is to be sent to the inquiry; and the office boy can do the rest.

In the case of many letters requiring answer —such, for instance, as inquiries for missing goods—the reply can be stamped across the communications received, instead of using new memorandum forms, and stationery thus be saved.

Public Letters.—It is always well to arrange for letters from the public to be registered separately, and for the replies to be marked off as they are sent, so that it may be seen by the controller or his chief clerk, day by day, what are still unanswered. Many of the public do not understand that, before their letters can be replied to, inquiries that sometimes take days to make must be made, and they frequently become irritated if they do not get what they want "by return"; it is therefore desirable that precautions should be taken against any avoidable delay in dealing with the communications, and a "public-letter register" forms a simple and effective check.

At some stations the correspondence relating directly to the despatch and receipt of goods is dealt with in the invoice and delivery offices, the reason being that the staff there are likely to know most about the goods to which the inquiries refer; but while this is to some extent correct, I think the small advantage thus gained is far outweighed by the disadvantage the system

Digitized by Google

creates through the interruption of the invoicing and delivery work, which, *per se*, demands the fullest and best attention that can be given to it, and therefore I consider it preferable to allot such correspondence to the ordinary correspondence office.

The same observations do not apply to the accounts and outstandings office, as the correspondence of that department mostly concerns questions of charges, for the particulars of which references have to be made to the books and returns of the office, and consequently, as a matter of convenience, it should be conducted there.

Controller's Personal Correspondence.—Correspondence concerning questions of management, staff, and other important matters should, of course, be conducted by the controller's personal staff under his own direction, and it is perhaps needless to advise that in organising this branch of the establishment he should select for his staff the " pick of the basket."

In these days the personal staff, besides being of the smartest, most intelligent and trustworthy, should be capable shorthand writers and typists, and it is worth while to let it be known on the station that " no others need apply."

The minor offices of a station—like the odd men in the operative section—are created by specific circumstances peculiar to the topography,

Digitized by Google

or rule, of the station; but they are not invariably all necessary, and it will be worth while to examine their work with a view to the possibility of dovetailing one with another and saving something.

Digitized by Google

CHAPTER VII

CONTROLLER'S SUPERVISION. VALUE OF DELEGATION OF MINOR THINGS. DAILY STATEMENTS AND REPORTS REQUIRED. HOW TO DEAL WITH THEM. REPORT FROM NIGHT INSPECTOR—ASSISTANT CONTROLLER AT LARGE STATIONS.

Controller's Supervision.—At this point the matter of the controller's supervision comes in, and it may be safely averred that under that head is to be found most that makes a good organisation successful or otherwise, according to its quality and exercise.

It neither consists in sitting in an office, nor in walking about all day, but in doing so much of both, as the two things are interdependent.

A good general does not spend all his time in dictating despatches and orders, neither does he devote it to drilling his soldiers; but he gives sufficient attention to both matters to ensure proper results—and so it should be with the station controller.

Value of Delegation of Minor Things.—The first essential in a controller is to cultivate a

Digitized by Google

wise discrimination as to what he should do himself and what he should delegate to his subordinates, so that, without missing personal touch with anything of consequence, he may leave to himself the greatest possible amount of time to see what everybody else is doing, and to think out possible plans for doing it better.

Some men's idea seems to be to try and do it all themselves, but it is a mistake, because they cannot, and in the effort they waste their time and demoralise their assistants.

The more one deputes to his assistants, the better it is for them as a matter of training; and as this makes them a greater asset to the railway, besides giving him the leisure for greater things, the principle may be safely adopted with advantage all round.

Daily Statements and Reports required, and how to deal with them.—Supervision commences with the morning's letters and returns.

Delegate as one may, there is every day a little batch of communications from headquarters, the public, and others which have been carefully selected by a responsible supervisor from the mass received, and must have his personal attention and directions. After that come the daily returns and statements reflecting the previous night's operations and occurrences, and the position of affairs at the moment.

Both letters and returns reveal the weakness of the station, or some other part of the line, and

Digitized by Google

it is from these sources he gets his material for thought and scheming.

There is this difference between the two, however. Letters simply show the things that have been found out, because probably they have hurt somebody, and are mostly the result of little side-slips; whereas the returns indicate the self-confessed shortcomings or difficulties of the station, automatically and faithfully described by persons who have neither the interest nor the desire to suppress or exaggerate anything.

The letters, therefore, may be considered to be of second importance to the returns; but as they are largely of the nature of criticisms which should be promptly replied to, it is desirable to take them in hand and dispose of them first.

No rules can be laid down for the framing of letter communications, because their substance depends upon the kind of matter to be conveyed; but it may not be amiss to advise that, as an act of business, letters to headquarters should be exhaustive of fact expressed in the fewest possible words, and that as a matter of diplomacy letters to the public should be as courteous as the author's power of composition can make them, without containing any admissions that might be used in support of claims for compensation. The returns, though conveying the most important food for consumption, are easier to deal with —if they are of the right kind, and are treated in the proper way; and here are a few suggestions

Digitized by Google

as to what statements should be called for each morning, and what should be done upon the information they contain, viz. :—

1. Times of the Arrival of Inwards Trains, and the Number of Loads they bring, with Brief Explanations of any Late Arrivals.

To be obtained from the number-takers and guards' records.

Call the attention of the superintendent to any chronic late arrivals, and remind him of the disorganisation they cause to the staff, and the probable inconvenience and loss to the public through the consequent late delivery of the goods.

2. Detailed Particulars of the Wagons Underload, specially recorded at about Eight o'Clock a.m., showing the Dates of Arrival, the Contents, and the Reasons why Underload.

Where the time allowed for discharge has been exceeded, press the consignees to unload without further delay; and if there is any shortage of wagons for use, arrange for as many as possible to be forthwith unloaded. In such cases it is more economical to spend a shilling or two in unloading a wagon than to allow it to be hung up indefinitely.

Digitized by Google

FIG. 7.—Chaining a Truck of Deals.

Digitized by Google

3. COMPARATIVE STATEMENT OF NUMBER OF MEN ON DUTY, AND THEIR APPROXIMATE COST, TO-DAY AND YESTERDAY—SHOWING THE DAY AND NIGHT SHIFTS, AND OVER-TIME SEPARATELY IN EACH CASE.

This can be prepared by the timekeepers, the cost of the men being assessed from the number of hours worked, at the ascertained average cost per man per hour.

Examine the inspector and foremen as to the cause of any increase which is not apparent from the state of the traffic or weather.

4. NAMES AND GRADES OF ANY ABSENTEES AND LATE COMERS, FURNISHED BY THE TIMEKEEPER.

Register under the names of the men, and in due course, either personally or by deputy, administer suitable cautions, and punishments to the inexcusable ones.

5. ESTIMATE OF WAGONS, SHEETS, ROPES, CHAINS, ETC., REQUIRED FOR THE DAY'S USE, WITH PARTICULARS OF THE QUANTITY ON HAND.

To be submitted by the inspector.

Compare with the actual user on the corresponding day last week, and judge as to the reasonableness or otherwise of the estimate.

Digitized by Google

Wire the stock regulator for any further supplies needed, and as to anything that can be spared.

6. REPORT BY THE CHIEF DELIVERY CLERK OF THE TIMES OF ARRIVAL AND SENDING OUT FOR DELIVERY OF ANY SPECIALLY URGENT OR PERISHABLE GOODS, PARTICULARISING ANY SUCH GOODS THAT HAVE NOT COME TO HAND IN DUE COURSE.

Where the controller is advised that traffics are specially urgent, they should be listed by the chief delivery clerk, and everybody concerned informed of their importance. The daily report should reveal any failures, which should be smartly dealt with.

7. NUMBER OF VANS CONTAINING GOODS FOR DELIVERY PASSING OUT OF THE STATION HOUR BY HOUR FROM THE COMMENCEMENT OF WORK, DISTINGUISHING THE COMPANY'S FROM OTHER VEHICLES.

To be submitted by the inspector from particulars recorded by the gatekeepers.

Compare with previous week's return, and investigate the cause of any apparent falling off not explainable by late train arrivals, bad weather, etc.

Digitized by Google

8. NUMBER OF INWARDS WAGONS OF GOODS UNLOADED BY STAFF, HOUR BY HOUR, BETWEEN THE START OF WORK AND 8 A.M.

To be obtained by the inspector from the foreman.

Deal with as in the case of No. 7.

9. TIMES OF DEPARTURE OF PREVIOUS NIGHT'S OUTWARDS TRAINS, SHOWING THE NUMBER OF LOADS EACH CONTAINED, AND THE CAUSE OF ANY LATE DESPATCHES.

The object being to send every train away strictly to time, any delay, even if only a matter of a minute or two, should be pressed home to the faulty quarter, whether it be a case of failure on the part of the engine-men, guard, shunters, or any other person.

Except in very special cases, a train should not be held back for wagons late loaded, as it is better to risk delay to a few loads of goods than to jeopardise a whole train. Let the train go to time, and deal with the cause of late loading.

10. REPORT FROM PERSON IN CHARGE OF THE STATION DURING THE NIGHT, SHOWING

(*a*) Number of men on duty, and how placed.

(*b*) State of the weather.

Digitized by Google

(*c*) Number of wagons loaded and unloaded.

(*d*) Difficulties and effects through shortage of stock, late departures of outwards trains, late arrival of inwards trains, bad weather, breakdowns on the line, or any other cause.

(*e*) Particulars of any failures of engines, machinery, staff, etc.

(*f*) Any unusual occurrences bearing upon the work, or of interest to the controller.

(*g*) Accidents to staff.

(*h*) Results of periodical fire-extinguishing practices.

(*i*) Number of outward consignments and wagon-loads not sent away the previous night compared with the corresponding night of the previous week.

(*j*) Time of finishing the loading previous night compared with the corresponding night of the previous week.

Assistant Controller at Large Stations.—The ideal organisation should include an assistant controller to take charge of the station during the night, as it is then, rather than during the day, that close outside supervision is required.

Digitized by Google

Men who have not had proper rest during the day are likely to get slack, and may idle in dark quarters if not well looked after.

It sometimes happens, too, that serious breakdowns and accidents occur during the night-time, and the person in charge of the station should be sufficiently qualified and powerful to cope with them.

Whether the individual be of that or any other grade, however, the controller should require full information as to the operations and occurrences of the night, so as to maintain continuity of action, or adjust any shortcomings, as the case may be, during the day.

Digitized by Google

CHAPTER VIII

CONTROLLER'S PERSONAL DEALINGS WITH STAFF. PUNISHMENTS.

Controller's Personal Dealings with Staff.—After the paper work has been disposed of, and any public visitors seen, it is time to give audience to any members of the staff who want "carpeting"; and in this matter it is desirable for the controller to lay down laws as to the cases in which he will personally deal with the parties, and which he will leave to his assistants.

If the supreme authority of a large organisation takes upon himself the duty of personally dealing with the staff upon all questions of discipline, engagement, breach of instruction, neglect, and other individual matters, he weakens the power of control of his assistants and loses something of the greatness that should be his in the eyes of the staff.

He should rather constitute himself to be of the dignity of a king of kings than that of a mere king, and make everybody under his authority understand and feel that it is a serious business to be brought before him.

Digitized by Google

FIG. 8.—Side View of a Load of Hops.

Digitized by Google

FIG. 9.—End View of a Load of Hops.

Digitized by Google

The inspector or chief foreman can be well deputed to engage extra hands and admonish the outside men for their peccadilloes, while the chief clerk can do the same with regard to the inside staff, and both will command respect for it.

The cases in which, among others that may arise, the controller is recommended to personally deal with the parties concerned may be thus summarised, viz. :—

1. Persistent or flagrant neglect of instructions.
2. Chronic bad time-keeping.
3. Continued bad or slow working — after caution.
4. Insobriety, or dishonesty.
5. Absence from duty without reasonable cause.
6. Insubordination or insolence to superior.
7. Fighting or serious quarrelling.
8. Using bad language.
9. Causing accidents of any kind.
10. Insecurely loading goods or appliances upon wagons or vans intended for movement.
11. Impertinence to public.
12. Appointments to service.

Punishments.—No punishments should be inflicted by anyone but the controller—unless by his deputy during his temporary absence from duty. It is necessary at times for the head of a section to summarily suspend an individual for serious misconduct, but the circumstances should

Digitized by Google

be reported to the controller and the person brought before him for judgment as quickly as possible afterwards.

In dealing with cases apparently calling for punishment, I have always been impressed with the necessity for being extremely careful to distinguish between unintentional errors of judgment and flagrant disobedience or misconduct, on the part of the individual, or individuals, concerned; and also for guarding against the possibility of prejudice among the witnesses or accusers.

Anybody but a brute greatly dislikes punishing at all, but when discipline seems to demand it, every shred of evidence in favour of the person concerned should be thoroughly investigated, and he should be given the benefit of any doubt.

The nature and extent of the punishment nominally depend upon the degree of the offence, but another factor that should influence the decision, and is yet sometimes overlooked, is the temperament of the offender.

There are highly sensitive men to whom a severe admonition would be a greater punishment than would a period of suspension, or even disrating, to others; and it may often be possible that, by giving a man "a good talking to" and appealing to his manhood, he may be converted into a valuable worker, while, by degrading him before his mates, the iron might enter his soul and he might descend from bad to worse.

Digitized by Google

It is therefore wise, as well as only fair, to consider the kind of man one has to deal with, as well as his iniquity, before passing sentence; and the spirit of the modern Police Court in condemning certain offenders to "come up for judgment when called upon" may be well adopted.

When drastic punishment must be inflicted, I consider it preferable to disrate or dismiss rather than suspend.

When a man is suspended with loss of pay, his family, if he has one, often keenly suffers, while he makes more or less of a holiday of the time he is off duty, and may possibly join "out-of-works" or loafers, with demoralising effects. Moreover, his job has to be temporarily provided for, which to some extent disorganises the work.

Disrating, which is a greater punishment to him, since he suffers degradation with some loss of pay, does not greatly injure his family, nor does it appreciably affect the work. It need not necessarily be permanent, and its duration may be measured by the enormity of his offence, and his subsequent conduct in his reduced position.

"Dismissal" is a terrible sentence to most men, especially after thirty years of age, and to the employer means the loss of more or less trained service, to be replaced by amateurism. Still, it must be unhesitatingly decided upon where discipline calls for it, and the only further word that need be said about it is—*Be sure the circumstances warrant it.*

Digitized by Google

CHAPTER IX

DAILY INSPECTION OF STATION. SHORTCOMINGS TO BE FOUND. AVERAGE LOADING OF WAGONS. ECONOMY OF FULLY LOADING TRAINS. RETURN OF DAILY LOADING OF WAGONS NECESSARY. CONTROLLER'S PERSONAL CRITICISM OF LOADING. SOME SUGGESTED RULES FOR PREVENTION OF ACCIDENTS TO STAFF AND OTHERS. REPORTS OF ACCIDENTS.

Daily Inspection of Station.—A walk round the station is the next item on the day's programme, and is always well worth the effort.

Every quarter should be visited, and every chief of a section be seen, or inquired for, as the knowledge that the "boss" will be coming along plays no little part in getting things done; it also encourages the responsible staff to point out difficulties that require superior brains to surmount, and to offer suggestions for improvements.

Shortcomings to be found.—On the way, the observant eye will catch things that are wrong, but which have not been reported because in

Digitized by Google

some cases they would not be detectable by a less experienced optic, and in others they have been overlooked.

The morning's returns and reports have revealed a lot, but they do not tell of the slow finishing of the inwards work which is perhaps taking place—possibly through want of strength, or slackness of supervision; neither do they force into the light that heap of goods for delivery which have arrived without invoices, and, being without addresses, cannot be disposed of. These are important matters for the controller, and he will take active measures with regard to them, which others should but have not done.

The same eye will notice some waste of time in the vans of goods leaving the station, for which the cause may lie in the delivery or cartage office; and that the vans of outwards goods which have begun to arrive are not being smartly attended to, perhaps because the full outwards staff have not yet come on duty; or, again, that the sidings in the outwards shed have not been "set" with the needful wagons for the loading of the goods—each and all of which defects demand prompt attention.

There are sheets and ropes lying about the place that should have been picked up and put away in the appointed place for them, and there is some disorder among the vans coming into and going out of the station or moving about the yard, through the want of proper regulation.

Digitized by Google

The yard is very dirty in places, which makes it inconvenient and nasty for people to walk about —all for the want of sweeping—and the stages and warehouse floors are disorderly because the men deputed to look after them are themselves disorderly.

In short, it is astonishing what unsatisfactory things that observant eye can cast a glare upon, before its owner goes to lunch; and these, with those he has already gathered from his other sources of information, plus what will be brought to him later, may well set him thinking and doing for the remainder of the day.

While it is necessary to make this personal visitation in order to find out things, the obligations of the responsible chiefs or supervisors should never be relaxed. Every little lapse or oversight should be swiftly brought home to them, and be made an object-lesson.

Such things are most likely to occur at the point where one man's responsibility ends and another's begins, and should be provided for when defining each one's duties, so that the real fault may lie with the person who has defined the duties. But whoever may be wrong, let there be no mistake about its being impressed upon him.

Average Loading of Wagons.—A highly important feature of the work for the controller's strong personal interest is the average loading of the wagons.

Economy of Fully Loading Trains.—The essence

Digitized by Google

of economy on the railway is to fully load the trains, and there is more scope for doing this in the merchandise department than there is on the passenger side, because the goods are controlled by the officials, whereas the passengers control themselves.

The train-load is determined by the number of vehicles—not the weight of the contents; and it follows that the greater the weight loaded into the wagons the greater the economy.

Loaders have no self-interest in making the most of the wagons, and on the contrary often find it easier to split up a quantity of goods between two wagons than to build them up on to one, which might suffice, and therefore they want constant watching and checking to secure the best results.

Theoretically, the foremen should see that nothing is wasted in this direction, but practically they have too many other things to do to give the subject the attention it requires, and it is found to pay at large stations to appoint an expert loading inspector to devote himself entirely to it.

Return of Daily Loading of Wagons necessary.—Besides this, statistics should be drawn out each day to show the weight of every load, and the general average per wagon—particularising the cases where two or more wagons are loaded to the same station,—for criticism as to whether the vehicles were used to the greatest advantage.

Digitized by Google

Controller's Personal Criticism of Loading.—If, in addition to adopting these measures, the controller will personally often examine and criticise the loading as it is proceeding, he will see the average slowly but surely creep up towards the standard of excellence, and will be able to congratulate himself upon having done a really good thing.

Some Suggested Rules for the Prevention of Accidents to Staff and Others.—Another special task for the controller himself is to devise and lay down rules for the protection of the staff against accidents.

It is well known that familiarity with danger makes men contemptuous of it, and therefore they must be guarded against themselves.

Unfortunately for this purpose, the stations and their working arrangements differ so much from one another that no standard regulations, beyond those contained in the Rule Book, can be set up for them, and it devolves upon each station to form its own ; but at goods stations generally the following may be adopted as needful precautions, viz. :—

1. No rail vehicles should be moved until a recognised signal, by whistle or otherwise, has been given.

2. After a signal for the movement of rail vehicles has been given, the work in any wagons standing on the line, or siding, affected should be suspended until the operation has been completed.

3. No loading, unloading, sheeting, roping, sheet-

Digitized by Google

tying, or labelling should be done while wagons are in motion.

4. No person should cross a line beneath, or over, the buffers of wagons without the permission of the person controlling the movement of vehicles on that line.

5. No person should cross a capstan rope attached to a wagon without the permission of the capstan operator.

6. No person should pass between the buffers of vehicles standing at only a short distance from each other until he has satisfied himself that no movement of them is about to take place.

7. Everyone should beware of the danger of passing between moving vehicles and the walls of a shed or edge of a platform.

8. Sheeters should not stand in the " four-foot " when doing their work.

9. No article should be placed on the ground within five feet of the rails.

10. Coupling and uncoupling wagons should be done by means of coupling-sticks, and brakes should be levered down by brake-sticks.

11. The floors of sheds should be kept free from slip and stumbling parts.

12. Any member of the staff guilty of placing himself in a position of danger should be severely admonished, and foremen and other leading hands should be required to strictly report every case coming under their notice.

It is advised that every case of " placing himself in danger " should be registered against the individual, and that if repeated suitable punishment should follow.

Digitized by Google

Reports of Accidents.—All accidents to staff should be classified both as to their nature and the persons involved, so that periodically they may be reviewed as to the extent to which they recur, and as to the possibility of adopting measures to prevent further cases.

Immediately an accident occurs, all witnesses should be closely cross-questioned to elicit the exact circumstances, and their signed statements should be obtained.

Many workmen have bad memories for facts in connection with accidents, especially after they have conferred with their mates and the injured person's friends. This has been particularly noticeable when a case has later been the subject of a Board of Trade inquiry or a coroner's inquest, and in such instances the signed statements, taken while the facts were fresh, have been invaluable.

Digitized by Google

CHAPTER X

DUTIES OF STAFF OFFICE. SELECTION OF STAFF. ADVANCES OF PAY AND PROMOTION. COST OF STAFF. TIMEKEEPING. OBJECT-LESSON OF CONTROLLER TO THE STAFF.

Duties of Staff Office.—The staff arrangements of a station, while necessarily conducted by a member of the staff, should receive very much of the personal attention of the controller, as upon good regulation in this department further depends the general efficiency of the organisation.

Among the more important things he should watch are the following :—

1. THOROUGHNESS OF CHECK UPON THE TIMEKEEPING, TO ENSURE THE ABSOLUTE CORRECTNESS OF THE PAY-BILLS.

This can be well done by arranging for each foreman to record his men's time in a book to be balanced with the timekeeper's record, and by having the results checked with the pay-bills by an independent accounts clerk.

Digitized by Google

2. Examination of Persons for Appointment.

Physical fitness being a necessity for the varying duties of the railway service, it should be regarded as the first qualification.

Persons whose condition would not permit of their performing night duty inside or out, or who may unfortunately suffer from defective eyesight, hearing, speech, or stature, should be rejected.

Given physical fitness, satisfactory credentials, duly verified, should be the next consideration.

The examiner should be always conscious of the fact that almost any person, however failing, can obtain what appears to be a good testimonial, because it costs the giver nothing and is a benevolent act to the recipient.

Even thieves, who contemplate robbery, sometimes manage to secure apparently good credentials; and, having regard to the valuables of a station, one cannot be too careful in the selection of new and untried staff.

3. Registration and Record of Staff.

At every station there should be kept a register showing, for each member of the staff, his date of birth, date of entry into the service, date of appointment, his rates of wages and grades, from time to time, and any faults for which he may have been admonished.

Digitized by Google

This is useful—and necessary for fair administration—when anyone is guilty of an offence, as length of service and previous conduct are circumstances that should weigh in dealing out punishment or overlooking faults.

4. Regulation of Advances in Pay.

Where scales for the graduation of pay exist, a system for giving due effect to them should be adopted, and this may easily be done by going through the staff register (clause 3) once a month and drawing out a statement showing who, by scale, will be entitled to advance during the forthcoming month.

It is usually made a condition of scale advances that the persons concerned should, by their conduct, merit them; and where this applies, and certain members of the staff coming within the operation of the scale do not appear to merit advance, I think it is advisable to tell them so—and why.

This, probably, will have the desired effect; but if it does not, it will be fair to both sides to cause the failures to leave the service.

Of promotion and long and good service advances little can be said, because they—like dividends—should depend upon the success or otherwise of the undertaking for the time being; but much can be done by the controller, where a large staff is employed, by "ringing the changes" in the rates of pay when filling up the vacancies

Digitized by Google

consequent on highly paid members of the staff falling out.

A man by long service frequently reaches a rate of pay beyond the actual worth of the position, and when he vacates it, notwithstanding that the person who succeeds to the duties may think he should also succeed to the pay, advantage should be taken of the opportunity to distribute advances without increasing the total expense.

5. Regulation of Cost of Staff.

The first step in this direction is made by obtaining from the timekeeper—as previously advised—a statement every morning of the men's hours of the previous day, and comparing it with the day before and corresponding day of the previous week; but a full view of the position can only be reached when the actual cost in money can be shown and compared with the operations, as illustrated by the tonnage, and discounted by any exceptional occurrences, such as accidents, breakdowns, fog, snow, heavy rain, etc.

This, with some clerical labour, can be ascertained day by day, if desired; but for all practical purposes it need not be got out oftener than once a week, and then from the pay-bills—which make no mistakes.

Every station, in these up-to-date times, has some kind of periodical return showing the relation of staff expense to tonnage, and the form

Digitized by Google

FIG. 10.—Side View of a Load of Waste-Paper Parcels.

Digitized by Google

FIG. 11.—End View of Load of Waste-Paper Parcels.

Digitized by Google

in which it is compiled—so long as its figures are correct—does not matter; but it does matter how it is looked at.

Ordinarily, if the cost per ton is up, there is agitation amongst all concerned to find some sort of explanation for the increase; while if it is down, they metaphorically smile and ask no questions.

Yet, as a matter of fact, the apparently unsatisfactory return may be, really, a good one, and the other bad, if proper regard be given to the conditions of the operations represented by the figures.

Tonnage, while accepted as the only available working unit to set against expense, is a misleading thing, unless so analysed that the different classes of traffic, and their quantities, can be shown separately at their known average cost of handling; and this could not be done to any appreciable extent without taking such elaborate records that the cost of them would exceed their value.

It is easy to distinguish handled from not-handled tonnage—and this should be done; but the difficulty lies in showing the variations of the former. A ton load of miscellaneous light parcels counts no more in a tonnage return than the same weight of barrels of beer, but there is a vast difference in the time and cost of dealing with it.

Really, while it is desirable for statistical and

Digitized by Google

comparative purposes to have a weekly return of the cost of working, the regulation of the cost should be done by daily observation and supervision.

6. PROGRESS OF THE STAFF.

Every man and boy should be encouraged to attain the highest point of efficiency, and for this purpose should be moved from one post to another as often as expedient, to gain fresh experience.

It is all too common a practice to keep an exceptionally useful person in one position unreasonably long, because he has made himself master of it, and it would be temporarily inconvenient to train somebody else to the duties; but it is neither fair to him nor his employers, as he perhaps delays his chances of promotion, and they lose for a while, if not for ever, his services in more important positions for which he might be particularly fitted.

No outside employer would allow a man qualified to be his manager to remain in a subordinate position for the mere convenience of another of his employees—if he wanted a new manager—and it is well for the controller to look at his staff in the same way.

Where a person of exceptional value cannot be promoted to a position worthy of his abilities, at the home station, he should be brought under the notice of the superintendent, so that he may have a chance of finding his level elsewhere.

Digitized by Google

Object-Lesson of Controller to the Staff.—Finally, let it be said that the members of the staff, as a body, take their cue from the chief. If he is thorough and prompt in his actions, they automatically become the same; and if, on the contrary, he is unsystematic and weak, they quickly develop similar tendencies.

It therefore behoves him to set the good example in all things. He should strive to be a model in punctuality, fairness, orderliness, and exactness, combined with all ordinary human virtues, and in proportion to his success in these attainments, so will the staff respect and admire him.

Digitized by Google

CHAPTER XI

DIFFICULTIES OF WORKING THROUGH WANT OF ROOM. ECONOMY OF SUFFICIENT ACCOMMODATION. SUGGESTED IDEAS FOR NEW STATIONS. DIFFERENT METHODS OF CHECKING GOODS. SUGGESTED ABOLITION OF INTERMEDIATE CHECK.

So far I have devoted myself to the matters that are of principal consequence in the arrangement of a large station *under existing conditions*; but as those conditions are not always ideal, it may be useful to offer some suggestions for their possible improvement.

The perfect station has yet to be built, and we may well consider how we could get nearer to it.

To do this, we must think of the difficulties of working under present conditions, and see how far better facilities would ease or remove them.

Difficulties of Working through Want of Room.—One idea immediately asserts itself at most large stations, and that is, that if there were more sidings and shed room there would not be

Digitized by Google

such delay and congestion as there generally is in dealing with the wagons and vans, every morning and evening.

I suppose the fact is that everybody has become so used to considering it an indispensable part of a station's ordeals that it should be overcrowded at these times, that when designing new places the possibility of providing against it is either not thought of, or the additional outlay that would be incurred in doing so appears to make it prohibitive; but I think a little reflection will show that that is not really the most economical view to take.

Economy of Sufficient Accommodation. — At most stations the morning trains arrive so closely behind each other that for want of room they cannot be promptly berthed, with the results that the engines are kept in steam unreasonably long, and perishables and important goods are delayed in getting to their places. The unloading men, whose numbers are limited to the accommodation, are pressed to get on with their work faster and faster, in order to quicker reach the more urgent goods that are blocked outside by those they are dealing with, while they are every moment becoming more hampered by the growing accumulation of packages on the stages awaiting their turn to be loaded on the vans. Meanwhile there is a struggle going on in the yard and docks, between the carmen and vansetters, in their efforts to find places for loading,

Digitized by Google

often ending in the strongest, but least important, getting first turn.

In the evening the vans loaded with goods for away arrive at the station faster than they can be accommodated, and have to be lined up in a queue to take their turn, although many of them contain goods that should be forwarded by early departing trains, for which they will be too late. The carmen and horses are kept standing, sometimes for hours, which is bad for both, as well as expensive; and it is practically impossible to pick out from the rank, and give precedence to, all the vans that contain the most urgent traffics.

On the stage only so many men can be worked in discharging the vans as the supply of the latter at one time will allow, which is the reason for the rank outside; and their task is constantly becoming more difficult through the increasing stacks of goods on the stage, waiting to be loaded into wagons.

The loaders are doing their best, but there is not room for the number of wagons they have to load; consequently many of the goods have to be put down on the stage until the wagons they are for the time being engaged upon are drawn out of the shed and replaced by others, which leads to damages, wrong loadings, and double handlings—all expensive—besides hindering the men who truck the goods from the vans.

Outside, the train-formers cannot get the

Digitized by Google

trains away to time, because the wagons they should take are not ready for them, although—mark it—the goods have been on the station for some time; so again we have waste of steam power, followed by numerous complications and difficulties through late train starts.

What a difference there would be if every station had sufficient sidings to accommodate its trains in and out, and standing room for its wagons and vans in position for prompt unloading and loading!

At least half of the present difficulties of management and control would disappear, and claims and complaints would be reduced to an inconsiderable quantity. The labour of the workmen would be rendered comparatively easy, and the chief anxieties of the foremen removed, while the bulk of the correspondence office clerks would have to find other occupations for their services.

Suggested Ideas for New Stations.—A lesser but not unimportant consideration in station construction concerns the type of the sheds for the loading and unloading of the goods.

These are usually of the fortress order, and would be capable of withstanding a moderate siege—but why? They cost a lot of money to build, and when, as traffic develops, increased accommodation is required, it takes a lot more to extend them. A large proportion of the expense is in the building of a shell that appears

Digitized by Google

to be unnecessarily strong for the things it encloses.

All that is wanted is a protection for the workers and goods, etc., inside against the elements, and it seems to me that for this purpose a corrugated-iron structure would generally suffice, and easily lend itself to expansion at a minimum of cost.

The platforms of the sheds should be sized according to the accommodation for wagons on one side and vans on the other. If there were ample room provided for the standing of the maximum number of both at one time, the platform could be of the minimum width to allow of reasonable sorting of goods, with gangways for trucking—say 25 feet—and thus trucking labour would be saved, and the handling of the goods accelerated. The length of the platform would depend upon the number of wagons and vans required to stand at one time.

Traverser power cranes reduce the cost of labour and increase the speed of handling goods in both sheds and warehouses, and should therefore form a part of the equipment.

Transporter tables, for transferring wagons from one set of rails to another, are much ahead of ordinary turntables, and also might usefully be adopted.

For the movement of wagons about the yards and sheds there does not, at present, appear to be any better device than capstans actuated by

Digitized by Google

hydraulic power. Electric capstans have been much improved since their introduction, but they have still the unfortunate weakness of suddenly breaking down if incautiously overloaded, and they are slow in starting.

Given full accommodation for vans inside, the approach road to the station should be as near as possible to the main traffic highway, to save unnecessary cartage.

In many cases the entrance to the station can only be reached after taking certain devious turnings through remote streets, which is uneconomical, inconvenient, and productive of delay.

Good light is essential in all the working parts of a station, and it pays to have plenty of the most powerful lamps as an adjunct to nature's supply, especially so in sheds where it is constantly necessary for the workmen to read the address labels and marks of packages.

Good light largely diminishes the risk of accident.

It is not suggested by these observations that anyone should at once propose the remodelling of his station on any or all of the lines indicated, but that the hints they convey might prove useful when considering new plans or developments.

Different Methods of Checking Goods.—The checking of goods is a matter worth reviewing, seeing that it is an expensive operation, and that

Digitized by Google

there is diversity in the practice of different railways.

The most common method is to check at every point—that is, out of van, into wagon, out of wagon, and on to van; but on some systems it is considered only necessary to check out of van at the forwarding station, and out of wagon and on to van at the receiving end, no check being made into wagon at the former.

By dispensing with this intermediate check, two great advantages are obtained, viz. a considerable saving in the cost of checkers, and a highly appreciable acceleration of the loading and invoicing. The only disadvantages to set against them are, that the separate numbers of the wagons in which the goods are loaded cannot be shown on the invoices, in cases where there is more than one wagon a day to the same destination, and that there is a little more risk of wrong loadings. They do not, however, nearly weigh with the advantages.

Suggested Abolition of Intermediate Check.—A modified system would be for a youth to take an inventory in duplicate of the goods as they are loaded into the wagon, and attach one copy to the side of the wagon for the information of the receiving station, the other being retained for reference upon reports of wrong loading. This arrangement in itself would tend to prevent wrong loading, as the person to blame would then be discoverable by the inventory; but the

Digitized by Google

FIG. 12.—Side View of the first part of a Load of Sundry Goods.

Digitized by Google

FIG. 13.—End View of the first part of a Load of Sundry Goods.

Digitized by Google

additional precaution of appointing one or two men to examine the addresses of the goods in the wagon as the loading proceeds might be taken for the express purpose of detecting and arresting wrong loading.

As a matter of experience, the checking of goods into the wagon with the consignment notes is found to be very unreliable.

More often than otherwise the checker—though he initials the note signifying that a package has gone into such and such a wagon—does not see it go, and simply relies upon his assistant to put it where he ought to, which he does not always do. When a report of non-receipt of a package comes along, both men will readily swear that it was certainly loaded into the wagon for which it was intended, although events often show that it was put into another one for a different place.

An inventory of the goods loaded, taken at the wagon side as the packages are put in, is much more to be depended upon than such a perfunctory check; and therefore, "taking one consideration with another"—I prefer the check-substitute, as being more economical, and no less effective, than the real thing.

Here is a specimen form for the inventory—

No. .....

From .....Station to .....Station. Date.....19.....

Wagon No..... Owner.....Ry. Sheet No..... Owner.....Ry.

Loader ..... Recorder .. ..

Consignee.	Address.	Goods.	No. of Pkges.	Marks.	Date of Label.	Condition of Goods.

Digitized by Google

Such a system could not be very well adopted in respect of goods for foreign railways without the consent of the latter, but there is nothing to preclude its introduction locally with the approval of the management.

Digitized by Google

CHAPTER XII

USELESSNESS OF CHECKING GOODS FROM TRUCK. ALTERNATIVE SYSTEM SUGGESTED. INVOICING BY TYPEWRITER OVER CARBON PAPER: ITS ECONOMY. ADVANTAGES OF SINGLE ENTRY. DELIVERY SHEET SYSTEM. ECONOMY OF THE ADDING MACHINE. DISTRIBUTION OF GOODS BY NUMBERS VERSUS NAMES OF STATIONS: SCHEME EXPLAINED.

Uselessness of Checking Goods from Truck.—The checking of goods into the station from the vans is necessary to test their actual receipt from the public, and it is also as necessary to check them on to the vans at the delivery station to assist in proving delivery; but it is a moot point whether it is worth while to check them out of the wagons, as it simply amounts to one hand checking the other, which should not be requisite.

The goods that arrive at a receiving station are either loaded out for delivery, or are on hand; and if the delivery records on the one hand, and the daily stocktaking returns on the other, do not

Digitized by Google

clear all the articles invoiced, it is reasonable to assume that the uncleared packages have not been received, and should be reported accordingly.

Alternative System Suggested.—In other words, if the delivery and stock records be checked to the invoice entries, any discrepancies should be disclosed with as good an effect as checking the goods with the invoices, and much valuable time and expensive labour in connection with the unloading of the goods from the wagon would be saved. The work of entering the goods from the invoices to the delivery sheets also would be greatly accelerated.

With the adoption of such a system, it would be requisite for the unloader to specially record any goods damaged when received, instead of remarking the invoices as at present, and goods received without addresses would need to be taken to one spot for identification with the delivery sheet entries.

It would be further necessary for the goods on the platform after the finish of the unloading and the sending out of the regular vans to be carefully listed, for the general clearance of the invoices.

Invoicing.—Invoicing by the system of pencil and carbon copying paper has not yet been so extensively practised as to be beyond mention.

Under the now " back-number " method of writing invoices in ink, and taking tissue copies

Digitized by Google

of them, much valuable time is lost in the process of copying, and often the copies are blurred and almost unreadable, leading to mistakes in the accounts office.

By the use of carbon and pencil the work is done quicker; the invoices are ready for despatch as soon as written; and—if proper care be used in the interleaving of the forms with live carbon paper—perfect copies of the documents are obtained, to the advantage of everybody having occasion to use them. Moreover, where it is of use, two copies can be made, one set being allocated to the correspondence referencers, and the other to the accounts office.

Economy of Invoicing by Typewriter over Carbon Paper.—Lately invoicing by typewriter and carbon paper has been introduced with even greater advantage, and is commended for the good reasons that there is a saving of from 10 to 25 per cent. in the work, compared with handwriting; and the typed wording and figuring minimise mistakes.

A further recent development in invoicing by typewriter is to make out the delivery sheet and bill of charges for the receiving station by the one operation of typing the invoice over carbon paper on to forms suitably printed, in addition to taking one or two copies of the invoice for home use.

The four forms are interleaved with carbon and made ready for the machine during the daytime,

Digitized by Google

so that no appreciable loss of time is incurred by the invoicer; but the labour and time saved to the receiving station are very great, and the sending out of the goods for delivery is accelerated.

Where extracts from the consignment notes for checking and invoicing purposes are made, it is more economical to have the work done by machine than by handwriting, and the work of the checkers and invoicers is facilitated.

Advantage of Single-entry Delivery Sheet System.—The partially adopted system of using single-entry delivery sheets is one well worth description, first, because it makes for practical economy, and secondly, because it is somewhat objected to by many of the indoor people, who apparently only look at the large number of separate documents it creates, without appreciating its value as a time-saver to the outdoor workers.

The arrangement is to write out a separate sheet for every consignment, and incidentally, by using a pencil and carbon paper, at the same time copy the particulars on to a bill form, thus in one operation providing all that is necessary for the loading checker and the carman.

The loading checker having only single-entry sheets to deal with, is able to fit up every consignment with a sheet as he comes across it, instead of turning the goods over to find the different consignments to fit the various entries on a sheet—as he does under the ordinary system—

Digitized by Google

FIG. 14.—Completion of a Load of Sundry Goods.

Digitized by Google

FIG. 15.—End View of Completed Load of Sundry Goods.

Digitized by Google

and thereby his work is much simplified, and the goods are loaded quicker. Further, he always has by him the sheets for which he has not yet found the goods, without necessitating the transference of any entries from one sheet to another, which, by the way, involves considerable clerical labour.

The mere fact that there are perhaps five times as many sheets for accountants and clerks to handle as there are under the plural-entry system is a triviality, when contrasted with the solid advantage of accelerating the practical work of the shed; and, after considerable experience with the single-entry system, I can strongly recommend it—despite the objection mentioned.

Economy of the Adding Machine.—An adding machine is another economiser that has recently found its way into railway offices where there are many additions of figures to be regularly made.

Tests show that a mere youth, by the aid of this machine, can make reliable additions faster than the average clerk can do so in the ordinary way, and that by concentrating the work upon him there is a saving of the difference between his rate of pay and that of the clerk.

Distribution of Goods by Numbers instead of Names of Stations.—The common method in outwards sheds of directing the truckers of goods from the vans to the wagon berths, is to tell them the names of the stations for which the goods are intended, and leave them to find their

Digitized by Google

way to the right places as indicated by the name-plates over or by the berths. This is all right where the truckers are permanent hands, but where they are largely composed of casuals, as they are at many places, and are ever changing, it is productive of much loss of time in the men finding their way, and many mistakes through goods being put down in wrong places.

When organising the Crewe Transhipment Shed upon its opening in 1901, and having practically all new hands to deal with, I found the mistakes and difficulties arising from this system were enormous, and therefore devised the scheme of numbering the berths in progressive order, and marking the numbers to correspond on the invoices for the guidance of the checkers, so that they could direct the truckers to the numbers of the berths and the men be able to find their way there, as a postman finds his way along a street of consecutively numbered houses.

The good effect from a working point of view was wonderful, as not only did the truckers get through their business quickly, and with a minimum of mistakes, but the checkers themselves were saved from giving wrong directions by having the correct destinations indicated in the numbers on the invoices, inserted by experts in the office.

Checkers as a class are marvellously well informed in railway geography, but it would be too much to expect of those having the responsi-

Digitized by Google

bility of distributing the goods at a large station, that they should be able to direct everything to the right berth without now and then taking time to refer to a guide-book or foreman for instructions—the trucker or truckers in the meanwhile standing still; and when this circumstance is considered with the difficulty of the casual truckers in locating the right berths among the medley of them arranged in geographical order, there is no doubt that the principle of numbers *versus* names would be of economical and practical benefit if applied to all stations where the conditions referred to obtain.

The Scheme Explained.—The essentials of the system are:—

1. Numbered boards, or plates, to hang up on the loading berths.

2. An alphabetically arranged station guide, showing the names and numbers of the loading berths, thus:

Name of Station.	Load to	No. of Berth.
Aber, L. & N.W. . .	Crewe.	187
Birmingham, L & N.W. .	Birmingham.	120
,, G.W.R. .	,,	47
,, Mid. . .	,,	84
Knockholt, S.E. & C.R .	Road Van.	21
Watford, L. & N.W. .	Camden Town.	121

3. An office near the place where the vans are unloaded for the marking of the consignment notes with the numbers of the berths to which the goods are to be sent.

Digitized by Google

Some loss of time must necessarily occur during the marking of the notes, but the markers very quickly become so expert with practice that they do their work with great rapidity, and what is lost at that point is more than regained by the quicker distribution of the goods through the assistance afforded to the checkers and truckers.

Digitized by Google

CHAPTER XIII

RETURNED EMPTY PACKAGES: SUGGESTED ISOLATION AND ARRANGEMENTS. IMPORTANCE OF REMARKING DAMAGES. GOODS SENT UNADDRESSED: HOW TO DEAL WITH THEM. UNDERCHARGING WEIGHT OF GOODS: TESTS ADVISED.

Returned Empty Packages.—At most large stations the returned empty packages are a bugbear, and, so far as practicable, should be separated from the goods and treated exceptionally.

As a rule it can be arranged, for many stations returning empties, to keep them together sufficiently long to make them into full truck-loads for the delivery stations, and where this is possible it should be done.

Suggested Isolation and Arrangements. — Whether they come in full loads or mixed with goods, it is economical in several ways to concentrate them in one place for sorting into delivery loads.

Where there is a covered shed available for this purpose the station is lucky, but the absence of one need be no reason for not adopting the principle

Digitized by Google

of concentration, as, unlike goods, empties, with a few exceptions, do not necessarily require protection from the weather. It is the workmen rather than the empties that it is desirable to cover.

The more important matter is to provide a platform for sorting the packages upon as they come out of the wagons on the one side, to be loaded into the vans on the other, and room for this can often be found on some spare piece of ground adjoining a siding or in some not too busy part of the yard. This may mean giving up something that will be inconvenient, but it will be worth considerable sacrifice.

The size of the platform must depend upon the average number of packages to be dealt with at one time, which can be gauged by the invoices. The length may be determined by the number of wagons likely to be put into position for unloading at one time, and the width by the extent of the storage required by the traders before delivery can be effected, some firms being unable to take in their empties as they arrive at the station; but for economy of trucking it should not be wider than necessary for the convenience of working.

Whatever the size of the platform may be, it should be marked on the loading side into delivery districts, and here the principle of numbering the districts can be well adopted.

Large firms should each have a number for the berthing of their empties, and the miscellaneous

Digitized by Google

be treated to numbers in groups, according to geographical position in the delivery rounds.

There is a difficulty in the checking of empties, where they are concentrated, that must not be overlooked.

Where they are in full wagon-loads they should be independently invoiced, and in that case the checking is straightforward; but when mixed with goods, they are sent to the concentrating point by wagon or van, with others, after the goods have been dealt with in the goods shed, and the invoices cannot always be sent with them, because they are required for the clearance of the goods.

Check upon Empties Received.—The checking of the empties in is, to my mind, not worth the expense of the operation, as its principal value is to discover shortages that but occasionally occur, and which, when not disclosed, only cost a little to repair—the expenditure from this cause being nothing as compared with the cost of labour in checking.

The unentereds will be revealed by checking the packages on to the vans with the delivery sheets. Where the sender's name is shown on the package there should be no difficulty in obtaining an entry from the sending station without quoting the wagon number in which it was received; and where it is not, the consignees might give the information. Failing both, the loss of carriage should be insignificant.

Digitized by Google

The question of remarking damages on the invoices need not be considered, because any defects can be noted in a book, as the packages come out of the wagon, and be afterwards endorsed on the invoices for reporting and claims purposes.

Checking out is very necessary, because many firms do not take proper records of the empties delivered to them, and some do not identify them with their senders, with the result that they frequently require the railways to prove delivery of certain packages that are in question between themselves and their clients, and if this cannot be done, claims frequently follow and must be met. Under these circumstances, I think the most effective and economical course is to adopt the single-entry delivery sheet system for local empties, and simply check the packages on to the delivery vans with the sheets, which, bearing references to the invoices, preserve identification with the senders, and at the same time reveal any shortages in consignments.

For the maintenance of the acknowledged system between different railways, it may be considered desirable to check in foreign empties, but for the reasons mentioned I do not personally think the game is worth the candle.

An alternative system to that of the single-entry delivery sheet is to take an inventory of the empties as they are loaded on to the van, showing the senders' names, when given on the

Digitized by Google

address labels, and use the document either as a delivery sheet, or for compiling the latter.

This, while simple in practice, however has the disadvantages that there is no guide for keeping the packages forming a consignment together, and unless the sender's name is shown on the package, there is nothing to identify him with it in the event of a dispute as to delivery arising.

Importance of Remarking Damages.—A point in connection with returned empties that does not usually receive the attention it deserves, is to note, when receiving them from the senders, any defects that may call for claims for damage by the consignees, or lead to their collapse during handling or transit, with the same result.

Valuable empties, such as ale and vinegar casks and metal drums, in a damaged condition, and frail packages such as crates and drapery empties, not fit to bear a journey, are often accepted from the senders and pass all hands without comment, when, by remarking the defects to the senders at the time of acceptance and endorsing the consignment notes and invoices accordingly, many claims for compensation would be avoided.

Goods sent Unaddressed: how to deal with them.—Another great difficulty to be contended with at large stations ensues from the non-addressing of their packages by many firms.

These senders have the impression that if they show the consignees on the goods they are giving

Digitized by Google

their trade away to competitors, and therefore adopt the system of simply marking them with certain hieroglyphics known only to themselves and their friends, and leave the railways the task of correctly delivering them with the sole aid of the consignment note.

They do not concern themselves with the fact that, as the goods have to be handled at various points between the start and the finish without the consignment note, or one of its consequential documents—the invoice and delivery sheet,—there is always considerable risk of their getting into wrong channels and being delayed in delivery, or perhaps lost, so far as the owners are concerned; neither do they care, if they are aware, that the cost of handling such goods to the railways is greater than that of dealing with addressed articles, besides involving more risk of expense by way of compensation for delays and losses. They are content to know that it has become an established practice for the railways to accept the goods under these conditions, and meet any claims arising upon them just as they would do if they were fully addressed.

The Government demand that all packages sent by parcels post shall be addressed, and nobody appears to be seriously hurt by it, which induces the reflection that, if the railways were to follow suit in their goods department, it would not be productive of any unreasonable loss to anybody.

Digitized by Google

There would, of course, be a shout from the trade at such an innovation, but no good case could be made out against it, since there would be no appreciable difference between the cost of addressing and marking; while the fact that the majority of firms at present address their goods, without any evil results from a trading point of view, should effectually silence the argument that there is danger in addressing. Meanwhile, it is desirable for the station controller to consider what is the best method of meeting the existing state of things.

Personally, I have found that much can be done to reduce the number of non-addressing firms by pointing out to them, as opportunities occur, that while the names of their consignees are necessarily shown on the consignment notes, invoices, and delivery sheets, there can be no real secrecy as to the destination of the goods, so far as the railways are concerned, and that the chances of discovery by outsiders, while the goods are on the collecting van, are so remote as to be not worth consideration. Further, that if they address the goods, the handling of them is so facilitated that delays in delivery, which are always annoying, if not costly, are practically avoided, and that therefore they have much to gain and little to lose by following the rule of the larger number of senders.

The best time for putting these things to them is when they are complaining of delays, but there

Digitized by Google

FIG. 16.—Crewe Tranship Shed.

Digitized by Google

are many other suitable occasions that will present themselves to the tactful person, and of which he will take full advantage.

The pretty generally adopted rule of dealing with unaddressed goods—although the senders are not much acquainted with the fact—is to label them with the consignees' name and station as they come off the collecting vans, and notwithstanding that this somewhat retards the operation of unloading, there is no doubt the loss is more than recovered from that time forward, through the workers at every different point being relieved from the necessity of identifying the goods by marks, to say nothing of the avoidance of the delays and complications arising from goods going wrong through not being addressed or labelled. Where labelling is done, however, it is important to see that it is done properly, otherwise worse difficulties may arise than when it is not attempted and the documents are relied upon to guide the distribution of the goods.

Labels for Unaddressed Goods.—Suitable labels for the various descriptions of articles to be labelled are most essential, as what will do for one class will not do for another.

Stiff paper labels fitted with strings are the most useful for canvas-wrappered packages bound with cord, and other articles having attachments or projections to which the labels can be securely tied; and similar labels fitted with thin wire ties can be easily fastened to

Digitized by Google

canvas-wrappered packages to which there are no attachments by threading and twisting the wires through the canvas.

Card labels should be used for wooden packages, including casks, and be tacked on to them.

Gummed adhesive labels should be used for articles for which neither tie-on nor card labels are suitable, and care should be taken to see that the makers provide them with gum of the right substance and quality to ensure their sticking on the goods after being fairly moistened and applied.

Ordinarily the duty of labelling is divided between the checker and caller-off who receive the goods from the van—the former writing the labels, and the latter affixing them; but, where practicable, I think it is a safer plan to compel the man who writes the labels to affix them, so that, when cross-labelling occurs, the responsibility for the mistake may be determined.

Where the undermark packages concentrated at one point are numerous, it is an economical arrangement to place a youth with the gang, to write and affix the labels under the direction of the checker.

The labels should be, if possible, written in ink, but otherwise in indelible pencil, as damp and friction soon render black lead pencil work undecipherable, and complications may result.

Undercharging Weight of Goods.—The railways lose a considerable amount of legitimate revenue through understatement of the weight of the goods they carry.

Digitized by Google

This arises mainly from misdeclaration by the consignors and careless computation by the workmen responsible for assessing the weights, and as the consequences are serious, special arrangements should be made at every station to test the weights of consignments both forwarded and received.

It is an unfortunate fact that some consignors, who would be horrified to be charged with dishonesty, deliberately state the weights of their goods to be less than they are, for the mere sake of saving a little in carriage; and they are encouraged to do so by the knowledge that it is the common custom of the railways to accept the consignors' declared weights, apparently without question.

These cases occur mostly in the sundry goods, the weights of which do not enter into the question of the purchase price, such, for instance, as drapery, earthenware, and hardware; but they are also found in articles that are sold by weight, such as cheese, bacon, and butter, the short declaration in the latter instances being the weight of the packing.

Tests Advised.—By a system, at the forwarding station, of checking the declared weights of a few senders in turn, day by day, these "mistakes" will be revealed, and each one should be made the subject of a special visit to the consignor, with a view to prevent a repetition.

The workmen's errors are due to a desire to

Digitized by Google

get through the work smartly, and while the cause is commendable, the effect is costly—unless arrested.

Even when the goods are passed over the weighing machine the weights are not always reliable, owing to the haste of clearing; but when, as frequently happens, there is a large number of similar packages in one consignment, and to save time the total weight is computed, there is great liability of making an underestimate, which may pass undetected.

The remedy consists in the first instance in having a sharp eye kept upon the weighers, and in the second, in having someone to devote himself to the testing of the weights of consignments after they leave the receiving checker, and making an example of every mistake thereby discovered.

As a further check, it should be a rule at all stations to systematically test the weights of their received goods.

If one or two forwarding stations goods be tested wholly, or in part, each day—as the times of arrival permit—there should be little inconvenience caused, and the results will be usually found highly profitable.

Digitized by Google

CHAPTER XIV

SMALL STATIONS. STATIONMASTER'S RESPONSIBILITIES, AND SUGGESTED RULES OF CONTROL.

Small Stations.—In what I have written up to now, I have addressed myself particularly to the large stations which, owing to their magnitude, are ever liable to become slack in their vital parts, with almost disastrous results, unless controlled by an unfailing system ; but in a modified way most of the observations will apply with equal emphasis to the smaller stations.

The main difference, for the present purpose, between a large station, such as a terminal depot in a big city, which I have so far had in mind, and a small one, which may be defined as anything from a station serving a town of 10,000 inhabitants to the remotest wayside place, is that the controller at the former obtains the best results from effective organisation, whereas at the latter it is done rather by personal supervision and activity.

At every place where there is a plurality of clerks and workmen, good organisation is a

Digitized by Google

necessary factor to perfect management, and many of the suggestions I have offered may be usefully applied; but at the wayside station, where there are perhaps only two or three hands all told, and the control is vested in the station-master, it is more a question of the latter's personality than anything else.

Stationmasters' Responsibilities. — The majority of stationmasters are bred in, and are paid through, the passenger department, and although this circumstance, from a business point of view, should not prevent them from taking as much interest in goods as in passengers, experience compels the observation that many of them do not take as much, and the not infrequent result in such cases is that the railway suffers through negligent working.

Perhaps, through defective train services, the goods arrive late, but the attention of head-quarters is not drawn to the matter, and the consignees who are inconvenienced thereby order their traffic to be sent by some competing means of conveyance. Still, perhaps, nothing is done, unless and until diminishing receipts call for inquiry by headquarters, when it may be too late to recover what has been diverted.

Wagons may stand underload and goods remain in the warehouse for an unreasonable period, for the want of proper notices to the consignees; undercharges in the weights and calculations of the tariffs and goods received

Digitized by Google

unentered may pass undetected, through the absence of checks; sheets and ropes may be lying about the sidings and get run over by carts or trucks, because careless men will leave them there unless looked after; weighing machines, cranes, and other appliances may deteriorate for want of proper protection and attention; and many other lapses of consequence may occur if the goods premises be not regularly supervised and ordered.

Goods Traffic as a Dividend Earner.—I am not sure that the full value of the goods department as a dividend earner is quite realised by many officials not closely connected with it, and this may partly account for some of the indifference occasionally displayed towards it; but as a good business asset there is no doubt as to its reality, and I specially commend an examination of its operations to every station-master who takes any part in its control.

It is perhaps only natural for anyone to be more attracted by the business in human passengers, with their variety of character and luxurious trains, than by unbeautiful goods, with their variety of smells and cold surroundings; but, as the sweep said, "It's not the soot, it's the money that matters!"

Delegation of Clerical Work.—Where the extent of the operations warrants the maintenance of a clerk, he should be trained to do the whole of the clerical work, except the

Digitized by Google

FIG. 17.—Unloading the "Yorkshire" at Crewe.

Digitized by Google

important correspondence, which the stationmaster would do well to personally conduct.

Where there is no clerk, the porter or porters should be made use of so far as possible. There is no reason why, after a little tuition, these men should not write the invoices (short of the charges); file the consignment notes; issue the advice notes; enter the delivery and warehouse books, and perform the other clerical duties, except those pertaining to accounts and correspondence. Some intelligent young men may be even educated into abstracting; writing accounts; and charging invoices, and should be encouraged in that direction for their own future welfare, as well as for the convenience of the station. Many young porters, thus trained, have developed into satisfactory stationmasters, and to all the knowledge gained is useful.

It is, however, necessary that the work should be checked by the stationmaster, in order to prevent possible loss through inaccuracies, as, no matter how earnest the porter may be in his clerkly duties, he has not the absorbing and vested interest of a clerk, and is much more prone to make mistakes.

Suggested Rules of Control.—Assuming the delegation of the ordinary daily office work to a clerk or porter, the stationmaster will find it help him in his control to establish the following rules of personal conduct, viz.:—

Digitized by Google

1. Walk round the goods yard, sidings, and warehouse first thing each morning, and again in the afternoon, to see that all goods and other traffic are receiving prompt and proper treatment, that wagons are not being unnecessarily kept underload, and that there are no sheets, ropes, or appliances out of order.

2. Look through the inwards invoices as soon as convenient every morning, to note what goods have arrived or may be expected, and see that due intimation is sent to the consignees, or that arrangements are made to effect delivery of them.

3. Require at the close of work each day a statement showing every wagon left underload, with the reason therefor, also a list of all goods on hand in the warehouse, referenced to the stock book or invoices, as a test that there is nothing on hand unaccounted for, or unattended to.

4. Write up the correspondence day by day, and do not leave duty until this has been done. Delay brings complaints which increase the work and reflect to the discredit of the station.

5. Do the abstracting, ledgering, and marking off of the cash daily. This saves time in the long run, and promptly lets you know where you are in the matter of outstandings.

6. When making up the books and balancing after the close of the month, do not neglect the current month's work, even though to proceed with it may mean putting in extra hours of duty.

7. Keep a register of the times of arrival of the inwards wagons, and advise the superintendent of any chronic bad time-keepers.

8. Advise the superintendent of any received consignments that have been too long on the way from the starting-point.

9. Advise the superintendent of any delay in taking

Digitized by Google

away surplus wagons, sheets, and ropes; also of any failure to duly furnish needful supplies of the same.

10. Economise the user of stores, fuel, stationery, and artificial light as if you had to pay for them out of your own pocket.

11. Don't allow strangers to walk about the warehouse or sidings, for the possible object of noting who the traffic is for or from.

12. Insist upon every member of the staff being courteous to everybody.

Digitized by Google

CHAPTER XV

LIVE STOCK. IMPORTANCE OF OBSERVING REGULATIONS OF BOARD OF AGRICULTURE. CLEANSING AND DISINFECTING TRUCKS AND PENS. CRUELTY TO ANIMALS.

Live Stock.—By the regulations of the Board of Agriculture, there is a responsibility resting upon the controller, in connection with the carriage of live stock, of which a good many persons in charge of stations do not appear to be fully aware.

Importance of observing Regulations of Board of Agriculture.—The Board issues from time to time very explicit orders as to the movement of animals, but they are so numerous and multifarious that, unless they are constantly and carefully studied, mistakes may be easily made that are calculated to involve considerable trouble and loss. As a preliminary measure, therefore, the controller at a large station should depute at least two or three of his responsible staff to make themselves thoroughly conversant with the orders; and at a small place he should make

Digitized by Google

himself so. In both cases he should personally see that the orders are preserved in such a way as to be always accessible for ready reference, when animals are tendered for conveyance.

Cleansing and Disinfecting Trucks and Pens.—As to the restrictions the Board imposes, and the licences it requires, they are ever varying to meet the provisions of the Contagious Diseases (Animals) Act; but there is one thing that never varies, and that is the obligation placed upon the controller to have his cattle pens and trucks cleansed and disinfected in accordance with the statute.

It is laid down by law that all pens, after being used by cattle, must be thoroughly cleansed of all animal matter and disinfected by midday the following day; also that the trucks must be similarly treated before being again used.

So far as the cleansing is concerned, no better method than to scrape away the dirt with a shovel or rake, and swill with water, seems to have been discovered up to now; and as this is a laborious and filthy operation, there is scope for inventive genius to design a mechanical appliance for making it easier and less unpleasant.

Disinfecting generally is done by limewashing with a brush, but recently a portable automatic limewash sprayer, actuated by air pressure, has been introduced to the railway world, which enables the operation to be performed more

Digitized by Google

effectively and economically, in about a sixth of the time, without any of the objectionable splashing of the operator which has to be endured when the ordinary brush is used. Moreover, by reason of the force behind the spray, the lime penetrates cracks and crannies where the brush would not convey it.

Cruelty to Animals.—Another matter of importance to the controller, is to see that no cruelty occurs in the loading of animals.

Many dealers and drovers, unfortunately, think more of saving a few shillings in the cost of conveyance than they do of any sufferings their dumb and helpless possessions may have to endure to effect it; and—again unfortunately—some railway men responsible for the loading are sufficiently callous, or are induced, to occasionally permit overcrowding of animals in truck, and to allow some to be loaded that are unfit to travel.

It is difficult to check these occurrences, except by personal observation; but much good may be done by emphatically prohibiting them, and warning the parties concerned that the severest official punishment, and possibly also the punishment of the law, may follow any disregard of the order.

Most irregularities take place in loading *fat* stock to the number of *lean* animals admissible to a truck of prescribed dimensions, and in accepting for conveyance cows nearing the

Digitized by Google

time of calving—two points that should be particularly watched.

Feeding and Watering.—It is necessary, when animals are likely to be so long on a journey as to require food and water during transit, or immediately upon their arrival at the destination, that arrangements should be made at the starting point for the provision of both at suitable places, and the needful instructions should be *wired* forward.

Digitized by Google

CHAPTER XVI

CARTAGE. BONUS FOR CARMEN. FACILITATING LOADING AND UNLOADING OF VANS. ISSUE OF DELIVERY SHEETS AND BILLS. TURNING OUT CLEAN TEAMS. SELECTION OF CARMEN.

Cartage.—Although the cartage arrangements at large stations are in some cases under a separate authority, it is necessary, even at such places, for the station controller to act a good deal in conjunction with that authority in order to produce the best results; and as at other stations he is directly responsible for the arrangements, it should be interesting to review the principal features of regulation.

Many of the railways issue books of rules for the instruction and guidance of the carmen—one of the newest being that of the S.E. & C.R.—so that I will confine myself to the important things, affecting control, that are not embodied in rule books.

Bonus System for Carmen.—In the first place, I consider it essential for effectiveness and economy to put the cartage staff on the bonus

Digitized by Google

system. It is even more so in their case than in the case of the station workers, because, unlike the latter, they are not much under observation, and when they waste time in the streets, they waste the horse strength as well.

The principle of fixing the carmen to certain rounds is pretty general, and where it applies there should be but little difficulty in assessing the weight value of each round and prescribing a bonus allowance for any increase.

Where, for practical reasons, rounds cannot be fixed, a graduated scale of minimum weights, for varying distances, can be easily formulated for the purpose of allowing bonus.

In either case, if the minima are reasonable, the results should be as satisfactory to the staff as to the railway.

Both carmen and van-guards, under this system, are alive to the value of canvassing for the cartage of any goods to be picked up, for stations their railways serve, and additional traffic may be sometimes thus gained, with advantage to themselves and their employers, as well as perhaps convenience to traders.

Without some monetary interest, the average carman prefers to collect as few goods as possible, to save himself labour and time.

With a bonus interest carmen will not only try to get maximum loads and avoid waste of time in the streets, but they will exert themselves to get their work at the station done as quickly

Digitized by Google

as possible, which greatly helps and economises the station arrangements.

This is of particular advantage at stations where the carmen load and unload the goods themselves, or with the assistance of the station staff.

Even at small stations where only two or three carmen are employed, the bonus system is good, because, when the men have finished the cartage, before their day is up, they can be usefully employed in the warehouse or yard during their spare time, which, under the non-bonus system, they would waste outside.

Facilitating Loading and Unloading of Vans.—The next important feature of cartage control is that of facilitating the prompt loading and unloading of the vans.

Much valuable time of men and horses will be lost on the station if the arrangements in this respect are not satisfactory.

Active regulation by cartage foremen working in co-operation with the shed foremen should secure the desired result; but independently of this, the time of commencing and finishing each load—when the horse is in the shafts—should be faithfully recorded by a responsible person, who should report any apparent slackness.

Where carmen's work notes are used, a remark as to the cause of any lost time from this or any other unusual cause should be made by the recorder on the back of the note, for the

Digitized by Google

information and criticism of the cartage supervisors.

If, in addition to this method of checking the loading and unloading, it be a rule to time the carmen in and out of the station, any waste inside should be discoverable and systematically dealt with.

At stations where it is the rule for the shed staff to load and unload the vans, the station controller, of course, entirely regulates the process; but he should still see that the carmen lose no time on the station, for fear that any smart efforts on his part, in the loading and unloading, may be discounted by delay at other points.

Issue of Delivery Sheets and Bills.—The arrangements for issuing the delivery sheets and bills to the carmen is another matter of moment.

These documents should be completed well ahead of the time they are wanted for use, and should be obtainable by the carman immediately he is ready for them.

The introduction of the single-entry delivery sheet and bill system referred to elsewhere has proved a great time-saver in this direction, particularly because there is no waiting by the carmen for entries to be transferred from one sheet to another.

Whatever may be the method of sheeting, it is desirable to prevent any waste of time in

Digitized by Google

FIG. 18.—Loading the Midday "Scotch" at Crewe.

Digitized by Google

taking unnecessary records from the sheets when the vans are ready to leave the station.

It is of course necessary to register the issue of the sheets to the carmen in order to check their return, but the operation should be as brief and simple as possible, consistently with the requirements.

It is a good plan to summarise the sheets upon slips as they are made out in the delivery office, showing thereon the numbers of them and the amounts of charges to be collected, and pass the slips to the cartage office, for the names of the men to be inserted as the sheets are handed to them. The slips then form a sufficient record for all practical purposes, and are ready for the cashier or whoever may require them, for securing the return of the sheets, and the paying in of the moneys debited upon them.

Turning out Clean Teams.—It is perhaps unnecessary to say that the horses with their harness and vehicles should be turned out of the station clean and smart, but it will not be amiss to remark that, the more exacting the controller is in this respect, the better will be the general results.

Many carmen take sufficient pride in their horses to look thoroughly well after their condition and the harness too, but there are many others who do not unless they themselves are well looked after.

The cartage inspector or foreman should be

Digitized by Google

required to overlook the horses as they come from the stable, and, when time permits, turn back any that are unsatisfactory, for proper attention.

It is also advisable to make at least a daily inspection of the stables, to see that they are kept clean and healthy and that the fodder is of the right kind and properly administered.

Horses are too valuable to be allowed to deteriorate for the want of proper treatment.

As for the vans, they must be kept clean by the station staff—except at small stations, where there is time during the week for the carmen to clean them—and definite arrangements should be made for attending to them as they may require.

Youths of sixteen or seventeen years of age are generally competent to do the cleaning, but old men who have got beyond more active work can be often usefully employed on the job.

Selection of Carmen.—The selection of men, as carmen, is a matter of some consequence, as not only have they to take charge of valuable horses, but they are entrusted with valuable goods that could be very easily "lost" on the road; and they are always liable to have accidents in the streets, resulting in injury to persons or property, that may be very costly to their employers.

At large places where van-guards are employed,

Digitized by Google

the latter form a useful nucleus for providing carmen; but at all stations it is necessary to engage new and untried men to some extent, and certain methods should be pursued as a preliminary to their employment, as a safeguard against taking in unsatisfactory ones.

The first essential is that the man should be of proved honesty. His testimonials should be absolutely clear in this respect, and, if practicable, each one should be verified by personal interrogatory of the person or firm giving it. In this connection it may be again pointed out that as a rule the giver of a testimonial says the very best he can of the individual concerned, and sometimes, in charity, obscures on paper weakness of conduct that the intending employer should know, but which upon verbal questioning will be revealed. Sometimes, too, the testimonials are manufactured by friends of the applicant, and it has occasionally happened that an intending thief has been engaged with such credentials.

The next point is, of course, that the man should be used to driving and attending to horses; also that he knows at least something of the geography of the district he will be called upon to work in. His past experience is the only guide to these things, and this should be ascertained at the outset by close questioning, apart from what his testimonials may indicate.

Finally, he should be physically sound in every

Digitized by Google

respect, and of courteous manner. Any bodily defect might bring him, or his employers, or both, into trouble during the course of his duties of driving and handling goods; and incivility on occasions might lead to loss of business.

Digitized by Google

CHAPTER XVII

STATISTICS. SUGGESTED RETURNS FOR WATCHING EXPENDITURE IN RELATION TO INCOME. OTHER USEFUL RETURNS.

Statistics.—At every properly organised station the controller should have such records of its operations that anything unsatisfactory in the earnings or expenditure will be automatically revealed.

The common rule is to take the tonnage as indicative of the income, and the wages as representing the expenditure, and from these two sums ascertain the cost per ton: which is all very well so far as it goes, but I do not think it goes far enough.

The tonnage, as a matter of fact, does not disclose the income, because it is made up of miscellaneous traffics carried at variable rates; neither does it constitute a reliable unit for setting against the wages bill, for the reason, as previously suggested, that mere weight does not indicate the labour required to deal with it.

I think that, besides taking out these figures,

Digitized by Google

it is desirable after the close of each month to take the poundage from the abstract summaries and see what percentage the wages bear to it; also to work out the average carriage rate per ton, which can be ascertained by dividing the tonnage into the poundage.

The results thus gained, with but little trouble, form excellent units for comparison, and prominently establish any increase or decrease in gross income, carriage rate, and wages cost, one period with another.

Suggested Returns for watching Expenditure in Relation to Income.—The following is a convenient form of recording the information, month by month in the first instance, and year by year afterwards:—

Period (Month or Year).	Tonnage.		Total.	Receipts.	Average Rate per Ton.	Wages.	Per-centage of Wages to Receipts.	Cost per Ton (Handled Weight only).
	Handled.	Not Handled.						
	Tons.	Tons.	Tons.	£		£		

Some further assistance in watching the expenditure can be obtained by analysing the wages, so as to show the amount that is going

Digitized by Google

in each branch of the station, and the percentage it bears to the whole, thus :—

Period (Week, Month, or Year).	Total Wages. £	Amount for Clerical Work. £	Per Cent. of Whole.	Amount for Shunting. £	Per Cent. of Whole.	Amount for Porterage. £	Per Cent. of Whole.	Amount for Miscellaneous Duties. £	Per Cent. of Whole.

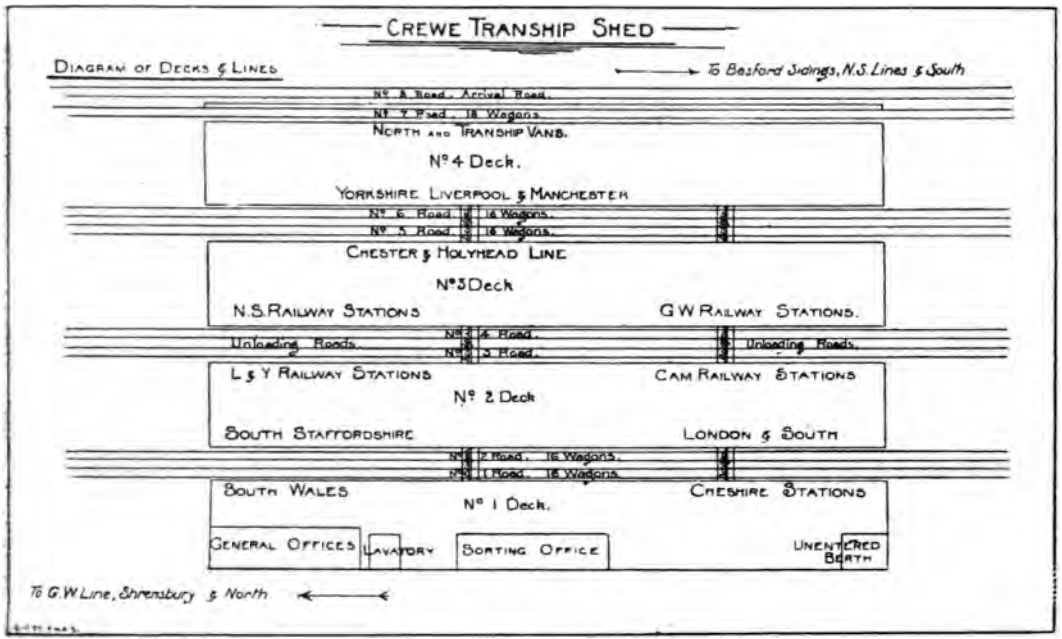
Where the clerical staff is paid by yearly salary, the amount under this head should be included with the wages to form a correct comparison.

In the shunting column should be included the wages of all persons connected with the movement of trucks, *i.e.* engine shunters, capstan operators, shunt horse drivers, and number-takers.

The porterage column is intended to include only the wages of men engaged in handling traffic, whom I have referred to elsewhere as the "productive" staff; and by "miscellaneous" I mean men who cannot be otherwise classified.

The chief value of such a statement lies in its revelation of the exact amount spent upon the productive work, but it will be found also

Digitized by Google



PLAN OF CREWE TRANSHIP SHED.

FIG. 19.

Digitized by Google

interesting as showing the cost of the other branches in relation to the total expenditure.

I am not a lover of elaborate statistics, but in the matter of expenditure upon traffic working I think it is worth while to analyse it to the bottom, as an exhaustive means of getting at any leakage.

Other Useful Returns.—Other useful records coming under the head of statistics may be briefly summarised :—

1. Loading of trains in and out, day by day, to reveal any light, or late, running.

2. Hours occupied by shunting engines, both in moving and standing, and the number of wagons dealt with.

3. Stocks of vans, barrows, hand-carts, sling chains, and other movable appliances of the station.

4. Fixed accessories, such as cranes, weighing machines, etc.

5. Tenancies, including wharves, offices, allotted spaces, etc.

6. Dimensions of stages, warehouse floors, yard space, and capacity of sidings.

7. Fire-extinguishing apparatus and appliances, showing where placed and the dates of the practices of the firemen.

Digitized by Google

CHAPTER XVIII

FIRE. SUGGESTED BRIGADES. CAUSES AND PREVENTION OF FIRES.

No station—small or large—is complete without some arrangements and appliances for extinguishing outbreaks of fire, and to this statement may be added—every station should take every possible precaution against such outbreaks.

Fires in sheds and warehouses sometimes occur through insufficient protection of gas-jets and fire-stoves, the dangers of which should be seen and obviated. They also occasionally happen through men surreptitiously smoking in hidden places, or under the stages, and carelessly throwing away lighted matches amongst straw or other ignitible material. These cases are difficult to prevent, for the reason that the perpetrators take care not to be caught in the act; but it will have some good effect if stringent instructions against the practice are prominently exhibited about the premises, and if any breach is severely dealt with.

Another necessary precaution is to arrange for all inflammable and other dangerous goods to be

Digitized by Google

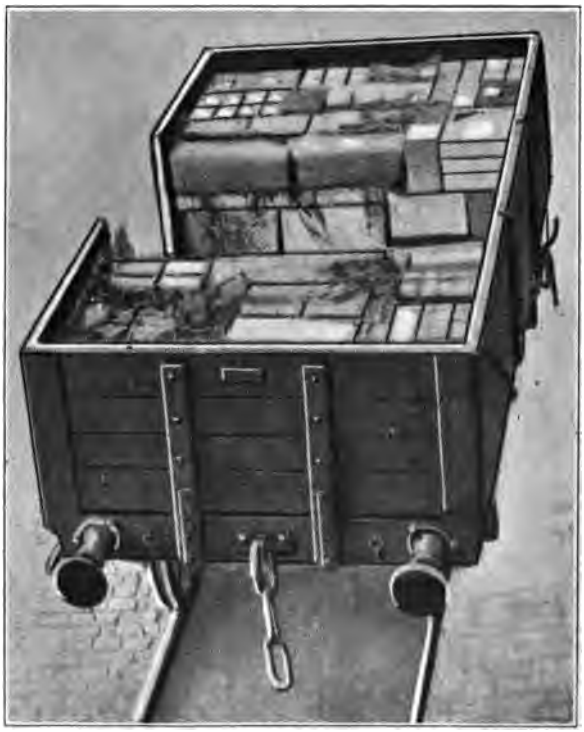


FIG. 22.—A partly loaded Truck of Miscellaneous Goods.

Digitized by Google

FIG. 21 —A Load of Miscellaneous Goods growing.

Digitized by Google

strictly isolated and placed under special observation while on the premises—unless they can be provided with a separate lock-up, as they are at some stations. Fires are most prolific, however, in trucks of goods during transit, and generally arise either through sparks from engines falling amongst something ignitible in the trucks, or from the spontaneous combustion of some of the goods.

When a perfect spark-arrester has been discovered and applied, the principal cause of mischief in this respect will disappear; but in the meantime its existence should be borne in mind when sheeting trucks of goods, and the needful precautions be taken on the lines indicated in the suggested instructions to loaders.

As to the outbreaks from spontaneous combustion, speaking from experience, it seems almost hopeless to impress certain reckless firms with the serious dangers and losses they expose the railways to, by handing in for conveyance innocent-looking traffic which is very liable to this risk, without mentioning its real nature; and it is only by furnishing the staff concerned with particulars of the goods they must be on their guard against, and insisting upon expert examination of any suspicious ones, that effective preventive measures can be taken.

The Dangerous Goods Instruction appended to the General Classification Book very fully describes the articles in question and lays down the

Digitized by Google

conditions to be observed in their acceptance; therefore it is unnecessary to particularise them, but the necessity of rigidly adhering to the instructions cannot be too strongly emphasised.

For the extinguishing of fires, there should be at every station of importance a local fire brigade, organised and regularly drilled, in a constant state of readiness to deal with an outbreak either on the premises or in a truck; and there should be posted about the station clear instructions stating what should be done in case of fire, and showing the names and private addresses of the men forming the brigade.

The strength and composition of the brigade must, of course, depend upon the area to be covered; the number of men available; the working of the shifts; and the appliances to be served. But whatever the composition, there should be regular practices upon imaginary fires, in the most inaccessible parts of the premises, supplemented by occasional surprise tests.

Each fireman should be provided with a distinctively sounding whistle, to be always carried with him and produced at any time when called for, and this should be the means of alarm.

At some stations a syren or bell is used for sounding the alarm, but it has the objection that it alarms outsiders as well as the firemen, and soon calls up a mob that—in a serious case—might be more difficult to deal with than the fire.

If it be made an order that anybody noticing

Digitized by Google

FIG. 22.—A Completed Load of Miscellaneous Goods.

Digitized by Google

an outbreak of fire must immediately proceed to an appointed place on the station—say the time office or a police box — where whistles should be kept, and report the occurrence, for the alarm to be sounded and taken up and repeated by every fireman within hearing, it should suffice.

A daily inspection of all fire appliances should be made, to see that they are kept clean and ready for use, as mentioned in connection with the inspector's duties, and any defects should be promptly remedied.

Fire buckets should be liberally placed about enclosed premises, and should be examined as often as possible to see that they are full of water. This is especially necessary during frosty weather, when the contents are very liable to become solid ice, unless previously salted or otherwise specially treated.

Digitized by Google

CHAPTER XIX

FIRST AID: VALUE OF QUALIFIED AMBULANCE MEN. POSSIBILITY OF CONTROLLER INDUCING MORE ENTHUSIASM.

Value of Qualified Ambulance Men.—It need hardly be pointed out that men on a station qualified to render "first aid," in case of accidents to persons, are a humanely valuable accessory, and that the more there are the better; but it must be admitted that under the generally existing conditions they are difficult to get.

The reason appears to be that, with comparatively few exceptions, the course of study of the work is too profound and time-taking for the class of men mostly invited to take it up, notwithstanding that some railways give them generous encouragement to do so, by granting them certain much appreciated privileges, and awarding handsome prizes to the more successful of them in competition.

Perhaps it is not to be wondered at that the majority of workmen engaged in manual labour are not eager, at the end of a good day's work, to devote their leisure to the study of the rather

Digitized by Google

dry—though scientifically useful—problems laid down as a necessary part of the education of students of first-aid work; and it may be thought also that the somewhat melancholy practices with supposed "patients" and the stretcher—which constitute a further essential portion of the study—are unattractive. But whether such conclusions would be correct, or not, there is no doubt that, unless the controller of a station manifests his personal sympathy with, and active support of, the work, it is not likely to be attended with the full measure of success.

Possibility of Controller inducing more Enthusiasm.—There are always at least one or two interested "first-aid" spirits on the staff, and a hint to them by the controller that he would like to meet as many as possible of the others, one day, to address them on the subject, would usually bring together a sufficient number of volunteers to form a "class." This being established, he should display his interest in its progress and make a point of personally attending as many as possible of the practices in drill and stretcher work.

An occasional Ambulance smoking concert among the men, under the patronage and presence of the controller, has been known to work a lot of good to the cause, as its best features have been then represented under happy conditions, and some of the desired enthusiasm has been infused among the men wanted.

Digitized by Google

It is at any rate good policy for the controller to meet the men as often as convenient to discuss the subject.

A regrettable feature of first-aid work is that the clerks do not sufficiently study it, although when they do they generally come out in the examinations and competitions with honours.

One would think that with their superior education and greater leisure they would be more enthusiastic than the workmen, and I cannot divine any satisfactory reason why they are not.

Probably they are indifferent because they are not sufficiently canvassed, or maybe they think it better to leave the workmen to themselves as a class; but whatever the reason, I think the controller would be wise to include them in his considerations and attentions when establishing classes and St John Ambulance Corps.

Doubtless our public educational authorities will one day make " first aid " work a part of the curriculum of both boys' and girls' schooling, but until that desirable time arrives, it behoves every responsible railway officer, as also the officers of other large institutions, to do their best to supply the present deficiency.

Digitized by Google

CHAPTER XX

TRANSHIPPING. THE CREWE SYSTEM EXPLAINED.

WHEN the L. & N.W. Railway established their great central tranship station at Crewe, they did much to cheapen the cost as well as to facilitate the operation of transhipment, and it may be useful to here reprint an address on the subject that I delivered to the Great Western Railway (London) Lecture and Debating Society at the end of the year 1907, and which was originally printed and issued in pamphlet form by that Society.

Great Western Railway (London) Lecture and Debating Society.

MEETING ON NOVEMBER 21st, 1907.

Chairman—MR C. A. ROBERTS, *Vice-President.*

THE THEORY AND OPERATION OF A TRANSHIP DEPÔT.

(*With special reference to Crewe Station.*)

BY MR F. W. WEST,

L. & N.W. Agent at Crewe.

In the first place, I should like to say how pleased I am to meet the Great Western Railway Staff at headquarters. International courtesies,

Digitized by Google

all the world over, are good, since they teach us to know each other better, and often something we did not know before.

It happens that my life for the past six years has been spent entirely in transhipping goods, and, therefore, it is quite possible I may be able to tell you something you did not know before; but no doubt you could tell me something in your particular vocations which would be new to me, and we, therefore, should be happy to welcome you at Crewe at any time. The subject of my address is "The Theory and Practice of a Transhipping Depôt."

The theory, so far as I can see, is to tranship goods as little as possible, but to tranship them effectively. Of course, it is needless to tell you that transhipping is necessary in order to economise wagons. The public would, no doubt, like us to send everything direct, from a pound of tea to a dead horse, but we could not afford wagons for that purpose, and therefore we have to strike a mean between sending goods direct and sending them short of their destination.

The London and North Western Company had to look round for a convenient central point to which they could send goods for circulation throughout the system. It was not a very difficult matter for them to select Crewe, because it is to the railway system what a hub is to a wheel. If you take a railway map and

Digitized by Google

look at Crewe, you will see that lines run into it like the spokes of a wheel. First, the London and North Western main line from London to the north runs through Crewe, and leads to the large Lancashire stations which are teeming with traffic. To the north-east are Manchester and Yorkshire, with the large towns of Halifax, Huddersfield, Leeds, etc.; and to the south-east is the North Staffordshire system, with Burton, Stoke, Derby, etc. On the west are Chester, Holyhead, North Wales, and Ireland; and on the south-west, Shrewsbury, Swansea, Central and South Wales, and the Great Western Railway system. Crewe is thus, as it were, surrounded by main lines to the principal places of the country.

That is why the Company selected Crewe, and it did not take them long to consider how they could concentrate the traffic at that point. The matter was simple from the first, and I may say that it has proved to be a thoroughly satisfactory and most economical arrangement.

I do not want to burden you with the ABC of the transhipping system, but will only say that if a station in Scotland has goods for South Wales it would load them to Crewe. It can usually load one wagon per day for Crewe, and the latter can make up one wagon per day for practically every large station on the railway.

Digitized by Google

I have prepared, for your information, particulars of our loading, and find that we make up wagons every day for from 250 to 300 stations. Some of these stations, of course, will take half a dozen wagons. For instance, London, Birmingham, and Liverpool will take six, some of them more, but we load to 250 or 300 different stations every day; and in addition to these we load roadside vans, which deliver goods on the following day to 519 stations; so that you see we have, in round numbers, to load daily to 800 different places. That practically covers the London and North Western system. We do not profess to load goods for a foreign company direct to destination in every case, but we *do* profess to load them direct so far as our own system is concerned, with but a few trifling exceptions, where goods are loaded to large centres for surrounding small stations reached from such centres by early morning or day services of trains and roadside vans.

The immediate effect of concentrating goods in this way has been that we have gained 1 ton per wagon in our outwards loading, as in 1901, before the tranship shed was opened, our average load was 1·10 tons per wagon (taking local, foreign, and roadside vans together), while to-day the average load is 2·10 tons per wagon. The 1901 figure for inwards loads was 1·7; it is now 2·1.

You will see from this the enormous economy

Digitized by Google

in wagons resulting from the concentration of the work at Crewe. I have a note here that if the general average of 1901—*i.e.* 1·10—had been maintained it would have required 36,466 more wagons to convey the traffic from Crewe during the half-year ended June 1907. That is a great economy, and illustrates what I am leading up to—the economy of transhipment.

From the Company's point of view this has relieved such large stations as Birmingham and Manchester, where we have withdrawn a great portion of the transhipping, because it enables them to deal with their own city goods more effectively. From the public point of view it is unnecessary to say that, if they get a two days' transit for goods, which they have had since the Crewe shed was opened, it must necessarily give a fillip to trade. Instead of having to order goods a week before they are wanted, traders can fairly rely upon getting them the next day but one. This must help trade all round.

METHOD OF WORKING

Of course, the Crewe shed has had to be organised specially, as it has not been arranged on the basis of any other station. In the first instance, I must explain that all our inwards wagons arrive either at the Basford sidings, which lie to the south of Crewe, or on the Yorkshire and Manchester lines at the north of the station. The wagons, as they arrive, are met

Digitized by Google

by two individuals. One records the fact that the wagons have arrived, the other removes the invoices from the wagon sides, and these invoices are conveyed with all despatch to the office, to be got ready to meet the wagons when they come to the shed.

We have two bicycle messengers who are entirely occupied, day and night alternately, in riding to the passenger station to fetch any invoices which arrive there. These are taken to the sorting office, and the first operation is performed by putting the transhipment stamp upon them. The invoices are then marked to indicate the loading berth at which the loading will ultimately have to be done. The number of the wagon and the place the goods come from are endorsed upon the back of each batch representing a wagon load, and they are then sorted alphabetically into pigeonholes to wait until the wagons arrive inside the shed.

As soon as the wagons are brought into the shed the checkers cast their eyes over the loads to see which are the best ones—so far as the lynx eye of the foreman will allow them any choice—and hurry to the office for the bills. The latter are entered to them, and their signatures obtained; but in the meantime the other portion of the gangs are eagerly undoing the sheets and getting the goods on to the deck ready to be dealt with. The method of unloading is very simple. The men work in gangs of seven—a

Digitized by Google

checker, a caller-off, an unloader, and four truckers. The three first-named are regularly appointed members of the staff, but the four truckers are generally casual labourers, engaged according to the ebb and flow of the traffic. As soon as the traffic slows down they cease, but the other three men are permanent hands and remain to finish the work.

The method is this. The unloader turns the goods out of the wagon, the caller-off seizes them, and calls out the name and address; but the checker, with the invoice marked with the number of the loading berth before him, does not call out the station. Assuming it is Cardiff, he calls out "31 on 1." All the berths are marked with big numbers, and the trucker, as soon as he hears the words "31 on 1," hurries away with the goods to that berth, and does not need to inquire his way. This is the whole operation, except that the caller-off endorses the number of the berth on the label of each package in case the invoice goes astray.

The goods having been unloaded in this way, the checker casts up the total of his invoices and enters the weight on his time sheet, with particulars of the wagon, sheet, etc., and the time he finished the work. He also enters on back of the time sheet the names of his gang from time to time as they may be broken up and reformed. The invoices are then collected and taken to the sorting office, where a clerk enters

Digitized by Google

the weight in his book. As soon as this operation has been performed the clerk passes the invoices to another man, who sorts them round the office according to the berth numbers, and there the documents remain until the foreman decides to make up a load—say to Cardiff, Manchester, or wherever there may be enough to fill a wagon. As soon as he thinks he has sufficient he sends the checker to the office for the invoices from 31, or whatever the number may be, and the goods are loaded up.

If he has not sufficient goods to make a *full* load (we study the loading of wagons very carefully at Crewe), and there is a margin before train time, he simply puts a label " Part Load " on it, and the wagon goes out of the shed, is worked round the sidings, and comes back again. This operation may be repeated three or four times until the wagon has been examined by a foreman, who sees that it is fully loaded, or that there are no more goods left to go forward that day. The loading checker, having made up his load, enters the weight and other details upon his work sheet in the same way as the inwards man, and his weight is checked by the clerk, who enters it up for bonus purposes. The invoices are then ready to be examined to see whether there are any duplicates. This we consider very important, because a careless man may send away a duplicate and an original invoice at the same time, so we select a good man for the work, and instruct

Digitized by Google

him to be very careful. After this, of course, it is a matter of detail that the invoices are despatched by the first passenger train, and the wagons are shunted to Basford, if for the south, or in the contrary direction if for the north.

THE "NUMBER" SYSTEM

We rather pride ourselves upon what we call the "number" system. When the shed was first opened we had some difficulty before we got our men in good working order. They were drawn from north, south, east, and west, and did not know each other. The shed was strange to them, and at first we could not persuade them to carry goods to the right place. A man would pick up a package for Cardiff and say to another, "Where's Cardiff, mate?" "Oh, over there!" would be the reply. The man would take the package across the shed, fail to find Cardiff, take it somewhere else, and eventually, perhaps, leave it on the deck in the wrong berth, so that at the end of the day we had many goods to be identified, which caused frequent delays and difficulties. This matter agitated my mind a great deal, and one day, while having my tea, I was struck by reading of the complaint of a postman, who protested against people calling their houses "Acacia Cottage," "Hollybush Villa," and that sort of thing. He pointed out that if they would only number their houses, he would be able to walk

Digitized by Google

straight to them, without running from one side and end of the street to the other. This rather impressed me, as I thought that this was the same difficulty under which we were labouring at the shed. I suggested to the manager that we should adopt a system of numbers instead of station names, and he fell in with the idea immediately, with the result that we had number boards and an alphabetical guide made. A few of the best men who knew the geography of the railways were selected, and in the course of a few days we instituted the practice of marking the invoices with the number of the berth in which the goods would have to be loaded, the effect being perfectly satisfactory.

One of the results is that anybody can be a checker. He does not need to know where, say, Abersychan is situated. He sees the number on the invoice, and sends the package to the berth indicated. Under the old system a checker might say to his mate, "Say, Bill, where's Abersychan?" "Oh, in Scotland!" would perhaps be the answer, and the package would be loaded to the North. Eventually it would get back to Crewe again, and another checker would inquire, "Where's Abersychan?" "Oh, in Ireland!" would be suggested, and the goods would be again sent off. At Holyhead the checker would say, "Where's Abersychan, whateffer?" "Inteet, it wass in Scotland, look you!" his mate would say, and so on. *Now*, when a checker

Digitized by Google

gets goods for "General Jones, Abersychan," all he has to do is to call out the number he sees on the invoice, "33 on 1," the trucker takes it straight to the proper berth, and the goods are found there and loaded up.

This number system is one which I can, after six years' experience, recommend to anyone for large stations, although I do not think it is adopted anywhere else. It could be used at any station, large or small, although at small stations it would, perhaps, be hardly worth the trouble.

THE BONUS SYSTEM

The bonus system, as established at Crewe, is rather an interesting feature. With the growing traffic we early experienced more and more difficulty in getting through our work by 5.45 p.m.—the prescribed time for finishing the unloading—as the following figures may illustrate, viz. :—

In the first half of	The average weight per month was
1901 . . .	15,000 tons.
1902 . . .	21,000 ,,
1903 . . .	24,000 ,,
1904 . . .	24,000 ,,
1905 . . .	25,000 ,,
1906 . . .	26,000 ,,
1907 . . .	26,000 ,,

You see from these figures that the traffic has nearly doubled itself since the shed was first

Digitized by Google

opened in 1901, and, as the business grew, we found it more and more difficult to get through by the close of the day. Having established the tranship shed, however, we were obliged to work it. It therefore seemed necessary to devise some means of getting through more work in the same time. As the result of much thought we made an experiment, commencing in July 1902, with the bonus system. It was started as an experiment, and has been continued ever since without any but an insignificant alteration.

The following is the system. Having taken out the average work done by the men, we decided that to every unloading gang of 7 men who could unload more than 42 tons in 10 hours, should be paid 9d. per ton as bonus on all weights over 42 tons, and to the loading gangs of 3 men a bonus of 5d. per ton on all weights over 23 tons in the same number of hours.

It will give you some idea of the result when I say that I recently got out statements to show what the checkers were making out of the system, and found that 20 men out of 60 for the previous 4 weeks had received an average bonus of 13s. in addition to a standing wage of 27s.; some had received an average of 12s. bonus per week, some 11s. and others 10s., but I do not think that any one of them had taken less than 6s. or 7s. over and above his wages. The total bonus earnings amongst the staff, including the casual labourers, who also work on the bonus

Digitized by Google

system, but make short time, varies 1s. to 20s. per week per man according to ability and energy. Some are drones, and do not try, but, taking big and little together, the average for a year is £12 per man.

This, I think, proves that it is a very good system from the men's point of view; and, as for the Company, it solved their difficulty at once, and it was not because the men exerted themselves so much more, but because *they wasted less time.* In the non-bonus time the men would go about as slowly as they possibly could, or stop to talk at the slightest opportunity. Now the trucker trots to his destination, and when he gets there trots backs again. Meantime the man at the wagon side is loading the barrows, and instead of putting on about half a hundredweight and letting the trucker go, he loads the barrow to its full capacity. He puts about half a ton on it if he can, and perhaps gives the trucker a small article to deliver somewhere on his way to the far end of the shed as well. And the men look after each other, as they are working for themselves. We have heard a good deal recently about railwaymen being dissatisfied. I cannot find that any of our men are dissatisfied while, as unskilled labourers, they can earn £2 per week.

I can recommend to you the bonus system as one of the most economical arrangements you can apply to the staff. Before the introduction of the bonus system our cost of working was

Digitized by Google

19·58d. (that is, 1s. 7½d.) per ton. The first half-year after its institution this was reduced to 18·90d., the next year to 18·41d., and for the June half of this year it was 17·43d., or 2d. per ton less than under the old system. The men are earning £3000 a year more, and the Company are saving 2d. on every ton they handle. The men are better off, and when they come round to the office sometimes for a quarter fare we scarcely recognise them. They are so smartly dressed we almost fancy they are customers, and want to touch our caps and ask what we can do for them.

UTILISATION OF WAGONS.

This, of course, means the economising of stock to the fullest possible extent. I told you a short time ago that when the checkers cannot find sufficient goods for a full load they send the wagon out, and it goes round and round the station until sufficient goods accumulate for a proper load. I do not want you to think that this means keeping wagons over till the next day. We despatch the whole of the traffic day by day, with but a few exceptions where, by keeping them back, we can save a further transhipment, and we never keep loaded wagons over until the following day. We make a foreman responsible for certifying every wagon—first, that the load is properly made and fit to travel, and second, that no room has been wasted. This is very

Digitized by Google

important in the case of foreign wagons. We get wagons from Scotland ; the goods are taken out, and almost before the axles are cool they are loaded again with goods for the Caledonian system. That has been a very powerful factor in saving wagons. I might tell you that, during the half-year ended June last, we received 19,000 foreign wagons, of which 13,000 were loaded back again. The remaining 6000 had to be sent away empty for various reasons, chiefly because we have not sufficient traffic for the Great Western and North Stafford Companies, who are on our doorstep, to load all their stock back to them, and consequently must return many wagons empty.

That is what I mean by the utilisation of wagons. It is a very great point in station working, and one that I always keep a tighter grip upon than any other feature. The men are very apt to send a wagon away empty if it means extra shunting to get it in position, and I have had great difficulty in getting the staff to fully appreciate the desirability of making the fullest possible use of foreign wagons.

DISPENSING WITH TRANSHIP RECORDS

You Great Western gentlemen do not seem to agree with us as to dispensing with records of invoices, and I think this is a good opportunity of explaining what are the advantages of the system. In the first place, I estimate that it

Digitized by Google

would require at least twelve clerks at, say, £800 a year, to enter the invoices dealt with at Crewe in a tranship book; but that would not be the most serious thing. If greater efficiency could be obtained it might be worth the expense, but the most serious factor is that it would take 50 seconds to enter each invoice, and as we get 7000 consignments a day, that would mean a total loss of 96 hours. This would be very much against expeditious working, as we load up to the last minute, and have to hurry to check the weights to enter them for bonus purposes, etc. That takes us all our time to do and get the invoices off by the first passenger train. So you see the loss of time that would result if we attempted to keep records of invoices, and I question whether it would be practicable to do this with the quantity of traffic dealt with. Now what would you gain by keeping copies? You would simply make a copy of what is on the face of the invoice. Anyone who has an invoice can see what it has gone through. There is the Crewe tranship mark on it, showing that it was checked in at Crewe on a certain date, then underneath it the number of the wagon in which the goods were loaded forward. If the goods were received at Crewe in a damaged condition there is a note to that effect. If there is no such note it must be assumed that the goods were not damaged on arrival at Crewe, or a careless checker omitted to make a note; but in any

Digitized by Google

case, a transhipping book would not assist you, as it would simply show a fair copy of the invoice. If the invoice goes astray, in 999 cases out of 1000 the goods find their way to destination. If the invoice gets astray before reaching Crewe it could not find its way into a transhipping book. If it does arrive safely and goes astray afterwards, you can then say that the goods did pass through Crewe; and in any case it is not once in a thousand times that both invoice and goods get lost. When they do, it is certain that a transhipping book would not enable you to find them. The book would only show that the goods were loaded to Crewe; and you could get that from the tissue copy at the forwarding station. During the six years I have been at Crewe I do not recollect such a case. When goods have got lost we have had the original invoice, and the goods have generally been found in our lost goods depôt without a label, or in some other lost goods depôt, and I maintain that a transhipping book would never have helped us to find these goods. When articles get lost you must look for them if you want to find them, and I maintain that the saving of time in dispensing with records far outweighs any advantage in the contrary direction.

REGULATION OF TRAFFIC AND EXPENSES

When wagons arrive at Crewe they are recorded by a man, who comes to the shed every hour and

Digitized by Google

posts up outside my office door, inside the chief inspector's door, and inside the door of the sorting office the number of wagons on hand at the shed and at Basford. I have a list here which starts—

6 a.m.	56	wagons at	Shed,	17	at Basford.
7 a.m.	68	,,	,,	18	,,
8 a.m.	53	,,	,,	34	,,
9 a.m.	57	,,	,,	27	,,

and so on, throughout the day. This enables us to judge when we can dispense with our extra staff. In the afternoon we get, perhaps, 60 wagons left, and we then knock off the casuals. They go to the pay-office and draw their money; the gangs are re-formed, proceed to finish off the remaining 60, and we just manage to unload the last wagon at 5.45 p.m.

To see that we get the right quantity of work done by the men, at breakfast time, between 8.15 and 9.0 a.m., the work-notes are gathered together and examined to see whether the right proportion of the 42 tons of unloading has been done. If a gang has not done its minimum by breakfast time (it is very seldom they fail, but sometimes the men are a little bit "off colour" in the morning), when the checker comes back from breakfast the inspector says, "Jones, you are short of your weight this morning. What is the reason?" Jones replies, perhaps, that he has had some rather awkward loads to deal with. "All right," says the inspector, "I'll tell the

Digitized by Google

foreman to give you a few good loads, and you must fetch it up by dinner time." At dinner time the sheets are again examined. Perhaps some other checker has got a bit slack, and he is told to make it up by 5.45 p.m. By this method we get what we want, and the bonus payments show that it is very seldom that we have to urge the men, as they usually get over the weight required.

That is how we regulate the work during the day, and is what I call foreman's regulation. The agent's regulation is this: When the weights for the day are all added up, the wages earned entered and the bonus for the day put alongside, the cost per ton is worked out. If we are a decimal point above what we were last week or the corresponding day last year, the agent says to the foreman, "You are ·10d. up over last week: fetch it down to-morrow," and he does. The result of this is that the figures I read to you are gradually decreasing, while the traffic is gradually rising.

It is a very simple matter, as every morning what I call the log-book is posted up, which shows me at a glance what the cost was for work done the day before and the corresponding days last week and last year, and, after allowing for the vagaries of the elements, traffic interruptions, and other disturbing things, I can judge whether we are right or wrong.

I think I have told you all that occurs to me,

Digitized by Google

and hope I have made myself quite clear. If not, I must apologise, and say that if any gentleman wishes for additional information I shall be happy to give it.

The Chairman, Mr C. A. ROBERTS, introduced the speaker, stating that, in his opinion, Crewe, with its lines radiating in all directions, was a most advantageous centre for the adoption of the transhipment system. Railways, he said, were endeavouring to load wagons to the best advantage, while the traders were pressing for greater despatch, and the question they had to decide was when to confine themselves to the pursuit of economy, and when to give way to the traders.

At the termination of the lecture, the Chairman invited comments and questions. Mr POLE asked whether a daily record of the loading of each wagon was kept; whether, as the Crewe men were doing so well and earning so much money, the scale of bonus payments was revised from time to time, and what was Mr West's experience in the use of large-capacity wagons?

Mr JOHNSON asked Mr West to explain more fully the process of stamping the invoices and to say what the stamp indicated. He also asked for information as to what was done with the goods left on hand at the end of the day.

Mr WALL asked Mr West what had been his experience in regard to goods received without mark, and inquired whether a consignment of, say, 6 or 7 cwt. of goods in one truck arriving at the transhipment shed would not, under certain circumstances, be left in the truck for re-forwarding and not be unloaded in the shed at all?

Mr GLOVER: Having had the pleasure of listening to Mr West, who has spoken for nearly an hour without any notes, I think we must come to the conclusion that he is a very capable, hard-headed, and practical

Digitized by Google

man, and that he knows his business thoroughly. I also venture to say that he is genial and humorous, and that he must be a very pleasant sort of chief to work under. Well, I only want, like Oliver Twist, having had my allowance, a little more, and will ask one or two questions. I do not venture to criticise, although I have heard other people question the North Western method of concentration at Crewe as resulting in goods being over-carried for considerable distances.

Suppose Crewe to be represented by "C"; the station where certain traffic originates by "A," and the destination by "B." If "A" has not got enough traffic for "B" to fill a truck he sends it on to "C," where it is unloaded and sent back over the same line to "B," and in this way goods may possibly be more delayed by over-carriage than expedited by the concentration system.

My second point is that if the cost of handling traffic at the depôt was 19·58 in the first year, was reduced to 18·9 and again to 18·41, and from that to 17·43, has Mr West got some ideal point at which he is aiming, or does he expect some day to get down to the proverbial last straw?

Mr West tells us that the work at Birmingham and Manchester has been greatly relieved by the new system at Crewe, and I want to ask him whether at Birmingham and Manchester the saving in expenses was reasonably commensurate with the extra cost incurred under the new arrangements, and further, whether, with this vast concentration at Crewe, he has been able to dispose of his traffic by the regular train service or whether he has to arrange specials, as was the case twenty-five years ago at Didcot when I was stationed there? We were then dependent upon arranging specials, as it were, from hand to mouth, wiring them along the line as they happened to be required.

I do not wish to take out of Mr West's hands the

Digitized by Google

answering of Mr Pole's question, but perhaps he will permit me to offer my opinion in regard to reducing the bonus, and that is that any attempt to reduce payments because the men do well out of the system would be fatal to the scheme. First of all, what is your idea and intention? It is to get the very best work out of your men by means of their exerting the maximum of muscular effort, and, after you have got that out of your men, would it be reasonable or honourable to reduce your bonus payments? I certainly do not think it would be right. Before I sit down I should like to again express the pleasure I have felt in listening to Mr West's able address.

Mr STEPHENSON expressed his appreciation of the honour he had received in being elected an honorary member of the Great Western Railway Debating Society, and said he had wished to raise the same question *re* overhaulage as had been put to the lecturer by the last speaker. He recognised that some amount of overhaulage was necessarily involved in any system of transhipment, but there must be some point at which the loss by overhaulage, added to the expense of transhipment, made the transhipment system too expensive for adoption, especially in other parts of the world where railways are not so favourably situated for concentration as the North Western. He asked what was covered by Mr West's cost figures? Unless these were inclusive of all expenses connected with transhipment, he thought they were somewhat high. He also inquired whether Mr West was able to get goods taken by barrow direct from one truck to another to any extent, thus saving the unloading on to the shed platforms? He supported Mr West in regard to the abolition of the old system of keeping copies of invoices, and stated that in his opinion the loss incurred through the absence of a tranship book would amount to a very trifling sum per annum, whereas the saving in labour by its abolition was very considerable. He also asked why men should be

Digitized by Google

allowed to pick and choose their wagons? He thought that this must inevitably lead to disputes, but doubtless there was a very good reason for it.

Mr C. A. ROBERTS inquired whether, in the course of the loading and unloading, it ever happened that more than one bonus claim could be made for the one lot of goods, and, if so, whether this did not tempt the men to transfer the goods to a greater extent than was necessary in order to increase the weight entered on their bonus claims? He entirely agreed with what Mr Glover said as to the suggestion to reduce the bonus allowance. It would be fatal to the system if, because the men were getting five or six shillings per week extra, an attempt was made to lower the payments, and men would not take kindly to the system at other stations. Mr West's figures went to show that the North Western Company had benefited as well as the men, and, in the absence of the bonus system, would have had to pay a great deal more in wages to extra men than had been expended in bonus payments. He expressed his gratitude to Mr West for his lecture, which had been specially interesting to him, as he had spent a good deal of his life in railway work of the kind described.

Mr WEST then proceeded to reply to the questions which had been put to him. He said :—

We do keep a daily record of the loading of wagons. The record is taken on the checker's work note. As every checker comes on duty he receives two notes—a buff one for goods unloaded by him and his gang, and a white one for goods loaded. The names of himself and gang are entered, the numbers of the wagons, whether wagons are North Western or foreign, and the time he finishes each load. This is the sheet which the foreman takes at breakfast time and dinner time to see whether he is doing sufficient work. These sheets are numbered consecutively, the checker adds up his weight for the day, and the forms go into the office for average loading purposes—that is, to ascer-

Digitized by Google

tain, in the first instance, what the loading of the wagon has been. The clerk scrutinises these sheets, and, if he sees one of them that does not look quite right, he goes out and sees the foreman or the checker. He might say, for example, " I see you loaded only 9 cwt. in a truck for Evesham yesterday. Why was that ? " The reply might be, " Oh, they were returned fruit empties," which would be quite satisfactory, because almost everybody knows that we load nothing but " empties " to Evesham.

The lists having all been totalled, he makes a statement for me. He enters the average load for local, foreign, and roadside wagons, and then he shows me what light loads have been despatched and the reasons for them, also what foreign wagons have been sent away empty and why, and the general average for the day, for the corresponding day of the preceding week, and for the corresponding day of last year, and if a slight improvement is not shown or level maintained, then the foreman and I have an interview.

Our bonus has been revised once. We started, in the first instance, by agreeing to allow loading gangs of 3 men 5d. per ton for all weights over 25 tons in the 10-hour day, and 9d. per ton to unloading gangs for all weights over 40 tons in the same period. After some little experience, we found that the unloaders were getting all the pudding and the loaders all the work, so the men were called together and asked whether they did not think it would be better if we took 2 tons off the loaders and put it on the unloaders (they all change round periodically, loaders and unloaders), and they agreed, and the revision was made accordingly. Beyond that there has been no revision. There have been several gentlemen at my place from time to time trying to persuade me that some of the men are earning too much and that the scale ought to be revised. I have said, " No, I promised the men this amount, and it would be a shabby proceeding to break faith with them." Nothing pleases me so much

Digitized by Google

as to see bonuses up over yesterday, because it all means economy in the station working. I will never be a party to reduction, and the management have, so far, I am pleased to say, supported me in that view.

The question as to the use of large-capacity wagons is a hardy annual with me. Large wagons are, I think, very useful for coal, bricks, manure, and commodities of that kind, but for miscellaneous merchandise there is nothing like the handy, mobile little 10-ton 4-plank goods wagon: you can load anything in them. I have one 15-ton wagon, but the men do not like it. It takes up the space of two ordinary wagons, and we are always sorry to see it arrive and glad to see it go. I do not agree with large-capacity wagons for general merchandise, but for coal, manure, and things of that sort, by all means have your large wagons, 50 tons if you like.

We only stamp our invoices once. The stamp is of the ordinary type, about the size of a two-shilling piece. There is a space for the number of the checker who checks the goods in (it is his sign-manual), and then the date the goods arrive. We once recorded the time the goods arrived and left, but we found that certain captious individuals would write and ask for explanations why certain goods were kept in the shed for three or four hours. The usual answer was that they were waiting for the next train to destination. We eventually omitted this portion of the record, and have had no trouble since. The invoice then passes to the loading checker, who enters the number of the wagon in which he loads the goods, and puts his number underneath, so that we may mark him down if he has not done the proper thing.

Goods left on hand at the end of the day are left in the shed, and then at a convenient time, usually about 9 o'clock, we have a gang of stocktakers who go round and pick up every article left on the decks. These are usually articles left over for the early morning trains. Some packages are found without labels,

Digitized by Google

some have lost their way through carelessness on the part of the loaders. These are put into the proper berths as far as possible; some are sent off by passenger train. There is a small number, usually about twenty a day, which cannot be identified with their invoices. These are brought to a place where all the checkers pass, and the checkers are asked if they remember the various packages. In the majority of cases the packages are recognised by the checkers. If the package is for a foreign station we keep it until there is an inquiry for it, and for this reason we used to be in trouble with the Great Western Railway and Midland Companies by sending goods by the wrong route. One of the packages for which the invoice was lost might be for Worcester, and we would send it by Great Western Railway as being the usual route. The Midland would hear of it—it was perhaps a special lot consigned by the Midland route as an exceptional case—and then the sparks began to fly.

There are, on an average, not more than three or four articles per day finally left over, and these are usually identified within the following three or four days; and at the end of every six months we have generally about a wagon-load of goods, which have been waiting unclaimed for that period, to be sent to the lost goods depôt.

As to goods received without mark, I wish we could compel every trader to mark his goods with cast-iron labels, but we label as many as we can of them. As to leaving goods in wagons, we find it more economical to take everything out on the deck, as this obviates the sending away of two underloaded wagons to one station.

In regard to sending goods beyond their destination to Crewe, that is a thing very little indulged in. It might be that Manchester wanted to send a package to Sandbach, which is the next station to Crewe in the Crewe direction, and would load to Crewe, to be sent back to Sandbach, but with our system of early

Digitized by Google

morning trains the goods would be in Sandbach by breakfast time. There is very little overhaulage, as there are smaller transhipping depots in addition to the large one at Crewe.

I was asked what was my ideal as to loading average. Well, I have no ideal. I always want to see a reduction of expenditure and an increase of traffic. It is well, I think, never to consider you have reached the ideal; always strive to do something better than before. Of course I have to tell the manager at times that I am afraid we have arrived at the bottom, and that there is no room for going further, but that is not always my private opinion.

Then, as to whether the expenditure at Crewe has been compensated for by savings at Birmingham, Manchester, and other places. I have no doubt whatever that this has been the case, but with the large growth of traffic at the centres named it is very difficult to express this exactly.

As to train services. We never run specials for purely transhipping shed goods, except, perhaps, in times of congestion through fog. With all the various lines converging on Crewe we are able to arrange a regular train service to all the principal centres, such as the North, London, Cardiff, Holyhead, etc., and we have about forty miles of sidings in which to marshal the trains.

As to the cost per ton which I have quoted, this is inclusive of everything except salaried staff.

In answer to the question *re* loading direct from one wagon to another, this cannot be done to a very large extent. This could be done at an ideal station, where you have as many loading berths as you have loading stations, but at Crewe we have only 87 berths, and we load daily to from 250 to 300 separate stations. The goods have, therefore, to be placed on the decks and double-handled.

There may be two bonus payments made on the same consignment, one to the unloaders and the other

Digitized by Google

to the loaders. If the foreman were to direct the gang to load a consignment straight from an inwards wagon into, say, a Great Western Railway wagon which happened to be conveniently situated, that would not be paid for as two operations, but the extra labour of loading would be considered as equivalent to the work of taking the goods to a berth, possibly at a distant part of the shed.

For geographical reasons, it would be practically impossible for the railways generally to concentrate their transhipment goods at a centre, as the L. & N.W. Company have been able to do at Crewe; but many of the methods in operation there might be imitated with advantage at other transhipment stations, always saving the intermediate checking of the goods, which, I think, as I have said elsewhere, might be safely dispensed with.

Digitized by Google

APPENDIX

THE SUGGESTED GOODS RAILWAY CLEARING HOUSE

AFTER writing what I have done, and before going to press, an eminent railway officer asked me if I had anything to say in my book about Mr Gattie's proposed Goods Railway Clearing House, and I replied to the effect that I had not, because I had simply tried to deal with existing things and conditions. It has since occurred to me, however, that, having regard to the great claims for the scheme put forward by Mr Gattie and his friends, it might be worth while to make a few observations about it, even though it is at present a mere " castle in the air."

As I understand the project from a lecture of Mr Gattie's which I once had the pleasure of hearing, the objects aimed at are twofold, the one being to cheapen the cost of carriage of goods by railway, and the other to free the streets of London from much of their heavy, slow-moving traffic.

The first is sought to be achieved by concentrating all London's railway goods in one station, to be known as a " Clearing House," there to be sorted by mechanical appliances instead of by the present old-fashioned method of manual labour; and the second by collecting and delivering the goods in " containers," or large packing-cases, to be conveyed between the traders' premises and the Clearing House on fast-moving motor trolleys.

On the face of it, both ideas must sound to the lay mind excellent, and probably quite practicable,

Digitized by Google

which may account for the recent inquiry through an evening newspaper, "Why are railway managers silent about the scheme?"

With the objects everybody interested must agree, and I do not think anyone would be more delighted at their attainment than railway managers, if for no other reason than that many of those gentlemen's difficulties of management would thereby disappear. But are they practicable under the present conditions of *trading* requirements? That is the question to be analysed and cleared up before the scheme can be favourably considered by railway experts.

Mr Gattie tells us that a large number of distinguished scientific and professional gentlemen have pronounced his mechanical inventions to be quite capable of doing what is expected of them, and there is no doubt that goods can be safely and swiftly roaded by containers and motor trolleys; but to the railway operator, who has the experience of providing for the traders, there is considerable unwilling doubt as to the practicability of either part of the scheme unless, and until, traders change their methods of doing their railway business.

Let us review these methods and consider whether it would pay the traders to alter them to suit Mr Gattie's requirements, for the sake of the promised cheapening of rates—which is really all that the traders would be interested in.

The goods of London consist of anything from a basket of tomatoes to a ton case of glass, and include thousands of different sized and shaped articles of varying weights and bulk. The traffic to be sent away to inland towns and places is collectable from the senders during the afternoon and early evening, but mostly between 4 and 6 o'clock p.m. The bulk of the traffic arriving from the country must be delivered from about 8 to 10 a.m., except fish, meat, and other market produce which is required by the consignees during the early morning.

Digitized by Google

These times are determined by the traders for their business purposes, and the railways have to conform to them, although it would be much more economical and convenient for the latter if the deliveries and collections could be spread out evenly throughout the day.

Many of the consignments consist of single packages, some addressed and some not. Some have to be carried along narrow passages and up or down stairs, and some have to be passed through small doorways or hatches at the traders' premises.

In the crowded markets and narrow city streets, where a great many of the most important firms' places of business are situated, the railway and cartage contractors' teams have to wait their turns to get to their objective, and frequently stand for hours before they reach there.

The carriers make no complaint of these difficulties because they recognise the fact that the traders have theirs too, and that in any case they, as carriers, must wait for the trade, since the trade will not wait for them.

Now, if I follow Mr Gattie's case correctly, it is an essential feature of his scheme that all goods to be dealt with at the Clearing House must be packed in containers, which are to be lifted bodily in and out of the traders' premises; and, moreover, the containers are to be ready for collection when the motor trolleys call for them, so that the Clearing House may be continuously supplied with traffic during the whole of the working hours. If that be so, I confess I cannot see, in the first place, how the containers are to be moved into the majority of existing warehouses; in the second, how unwieldy and bulky articles, such as summer-houses, cases of glass, motor cars, and the like, are to be packed into them; in the third, how they are to be manipulated across the footpaths of busy and narrow thoroughfares, such, for example, as Wood Street and Bread Street, London, E.C.; and,

Digitized by Google

lastly, how the traders are to be persuaded to receive and hand over their goods at the times prescribed by the Clearing House, instead of at those most suitable to their business.

It may be remarked that there is nothing new about the idea of " containers," as they have to some extent been in use for years past for conveying certain classes of goods between some senders and consignees, and there is no doubt they are very good things where they can be employed, but this is found to be practicable only in isolated and special cases.

As for the times of delivery and collection being made to suit the Clearing House, it is possible that, if that institution were the only one available for dealing with goods, the traders might be largely coerced into conformity with its requirements, as they at present conform to the rules of the Post Office ; but it is scarcely likely that, after being nursed in the way, and for so long, as they have been by the carriers, they would submit to anything of the kind, and Mr Gattie would most probably realise the ordinary railway experience of having nearly all his outwards goods tumbling in upon him between 5 and 7 o'clock in the evening, for trains that must depart within the next two or three hours in order to reach their destinations early the next morning.

He would certainly have matters more in his own hands with the delivery goods, because he could send them out as he might find convenient; but if the traders were in the same frame of mind as they are now, there would be rough times at the Clearing House if they did not receive them first thing in the morning !

Another important matter for consideration in connection with the question of collection and delivery is, what would become of the host of road carriers who at present subsist by doing the work ?

Without ignoring the old law of nature that the fittest should survive, could it be reasonably expected that these worthy and long-established adjuncts to

Digitized by Google

trade would consent to be effaced, and is there any sufficiently good reason why they should be ?

True, the presence of their vans in the streets is somewhat burdensome, but they are by no means alone in that respect, and this fact by itself would be no more justification for their abolition than would be the pulling down of St Paul's Cathedral in order to widen the road.

It might be possible to buy them out if enough money were subscribed for the purpose, and this would probably be a satisfactory solution of the problem; but I rather believe the idea is that they should clear themselves out and invest the remnants of their capital in the Clearing House, with a view to taking interest as a *quid pro quo* !

Coming to the Clearing House itself, where the mechanical distributor of goods is to justify the whole scheme, I must say that Mr Gattie appears to have invented an exceedingly clever device, which, if applied only to straightforward and evenly fashioned, undamageable packages, would probably perform what is claimed for it.

It happens, however, as previously remarked, that the goods of a railway do not take this form, and, as I put it to Mr Gattie on the occasion of the lecture referred to, it would be interesting to know what would occur on the moving platforms if a large case of glass, a crate of eggs, a summer-house, and a live bull in a crate—all bent in opposite directions—were to meet at the converging point.

The central notion of the moving platforms is to convey the goods from point to point without the aid of men acting as truckers; but it must be remembered that these men not only supply the power of conveyance, but, on arrival at their destinations, they unload and stack the goods where they are required.

Further, during the process of trucking they take care of the goods according to the nature of them. A case of glass must be kept carefully on its edge; a

Digitized by Google

case of eggs must be lifted and lowered as gently as a coffin; and a bag of offal, or rancid fat, must not be allowed to come into contact with any other goods likely to be damaged thereby.

I do not know whether Mr Gattie's mechanism will provide for these things, but it is important that it should.

It might be the intention to sort the goods, on arrival at the Clearing House, into containers for the various stations, and so send them along the moving platforms; but in that case, unless the containers were sent forward to the stations, the goods would have to be twice handled at the Clearing House, which would neutralise the economy of the machinery. If the containers *were* sent forward, it would necessitate the partial reconstruction of half the stations in the United Kingdom to accommodate them, and involve much light-train running for their return, which would not be an economy.

Railway engineers for years past have been trying to devise moving platforms for goods sheds that would be practicable, but they have always been faced with these difficulties, besides others which need not here be mentioned, and therefore nothing of the kind has yet come along.

If Mr Gattie's invention has really solved the problem, there does not appear to be any reason why it should not be applied to railway goods stations without troubling about a Clearing House; but that possibility still remains to be demonstrated to persons who are familiar with the requirements of the traffic.

Digitized by Google

INDEX

	PAGE
ABOLITION OF INTERMEDIATE CHECK ON GOODS ...	... 91, 94
Accidents to staff, prevention of	... 73, 90
Accommodation, economy of sufficient...	... 86
Accounts clerks, training for	... 47
Accounts, deductions from	... 47
——— outstandings	... 45–47
Adding machines	... 102
Addressing goods, advantages of	... 112
Advances in pay, "scale" and "merit,"	... 78
Advising consignees of goods on hand	... 119
Ambulance men, value of qualified	... 150
Appointment, examination of persons for	... 77
Arrangement of "shifts"	... 23 24
Average loading of wagons	... 71–72
BOARD OF AGRICULTURE REGULATIONS	... *125
"Bonus" schemes for non-productive staff	... 22, 23
——— system for carmen	... 129
——— ——— general principles and effects of ...	... 12, 13
CALLERS-OFF, DUTIES OF	27
Capstan power, movement of trucks by	4
Carmen, qualifications and credentials of	136, 137
——— selection of	135
Carmen's work notes	131
Cartage	129
Cause and prevention of fire	143
Checkers, duties of	26
Checking goods from truck	96
——— by delivery and stock records	97
——— of returned empties out of wagon	108
——— ——— to consignees	109
——— weights and charges	120
Claims for damage to returned empties	110
Cleansing cattle trucks and pens	126
Clerical staff	40
Congestion of station, want of room	... 85–86

Digitized by Google

PAGE

Consignment notes, "extracting" from 99
Controller, assistant, at large stations 61
——— example of, to staff 84
——— personal correspondence 51
——— personal dealings with staff 63, 66
——— supervision 53
——— ——— daily statements and reports 54
——— ——— delegation of minor matters 53
Copying invoices by carbon paper 97, 98
Correspondence, "carbon" copying of 49
——— controller's personal 51
——— methods of division 48
——— "not to hand" and "unentered" reports 49
——— office, best position for 48
——— public letters 50
——— rubber stamps for stereotyped replies 49
Cost of staff 79
Cranes, types of 3
Cruelty to animals 127
Cultivation of traffic by carmen... 130

DAILY INSPECTION OF STATION 69
——— loading statistics, criticism of 27
Damages to returned empties, remarking of 109
Delay in "setting" outwards shed 70
——— to vans in leaving station 70
——— ——— on station 131, 132
Delivery clerks 40
——— of returned empties 109
——— sheeting, single and plural entry 99, 102
Different methods of checking goods 90, 91
Disinfecting cattle trucks and pens 126
Distribution of goods by numbers 102, 103, 104, 105
Division of correspondence 48

EFFECTS OF INSUFFICIENT ACCOMMODATION 86, 87
Expenditure in relation to income 139
"Extracting" from consignment notes 99

FEEDING AND WATERING LIVE STOCK 127
Fire alarms 147
——— appliances, daily inspection of 149
——— brigades 147
First aid 150
Foremen, arrangement of 16, 17
——— duties of 15
——— essential characteristics for 16

Digitized by Google

PAGE
Foremen, general rules of control 17
Framing instructions to workmen 39

GANGING OF MEN 6
——— general principles 7, 10
Gangs, composition of 6
——— "loading" and "unloading," 6, 10, 11
Goods received without address 97
——— sent unaddressed and under mark 110, 111

HORSES, ATTENTION TO 134
Hydraulic-power capstans 89–90

IMPORTANCE OF GOOD INVOICE AND DELIVERY CLERKS ... 40
Improvements, suggestion of 3
Indoor staff 40
Inspection of station, shortcomings revealed by 69–70
Inspectors, responsibilities of 17
——— rules of control 18, 19
Instructions as to duties of staff 26
——— in case of fire 147
——— to workmen, framing and issuing 39
Intermediate checking of goods 91
Invoicing and delivery sheeting by typewriter 98
——— by pencil over carbon paper 97, 98
——— by typewriter, economy and advantages of 98
——— clerks 40
Inwards working, "unentereds," 70
Isolation of inflammable and dangerous goods ... 143, 146
——— of returned empties, advantages of 106
Issue of delivery sheets and bills to carmen 132

LABELLING OF GOODS UNDERMARK 114
Labels for unaddressed goods 114, 115
Late train arrivals 119
Letters to headquarters 55
——— to public 55
Listing of undelivered goods 97
Live stock regulations 125
Loaders, suggested instructions to 28–39
Loading and unloading vans 131
——— berths, numbering instead of naming ... 102, 103, 104, 105
——— controller's criticism of 73
——— of wagons, economical 71–72
——— "slipping" of goods 11

Digitized by Google

PAGE

MEANS OF CLEANSING AND DISINFECTING CATTLE TRUCKS AND PENS 126
Methods of checking goods 90, 91
Miscellaneous staff, "bonus" schemes for 22
——— organisation of 20
Movement of trucks by capstan power 4

NEW STATIONS, SUGGESTED IDEAS FOR 88
Night work, report on 60–61
Non-productive staff, arrangement of 20, 22
"Not to hands," goods 96, 97
——— returned empties 108

OUTBREAKS OF FIRE 143
Outstandings, cause and prevention of 43

PAYBILLS, CHECK UPON TIMES WORKED 76
Percentage of wages to earnings 140
Piecework, rates of payment 13
——— system, see "Bonus," 12
Preservation of instructions to workmen 39
——— of regulations *re* live stock 126
Prevention of accidents to staff... ... ... 73, 90
Protection of appliances 120
Public letters, registration of 50
Punishments, infliction of 66–67

QUALIFICATIONS OF PERSONS FOR APPOINTMENT 77

RAILWAY GOODS CLEARING HOUSE 181–186
Record of delivery sheets issued 134
Registration and record of staff 77
——— of delivery sheets 134
Regulations for prevention of accidents to staff 73
Reporting of accidents to staff 75
Retarding progress of efficient staff 83
Returned empties, defects in 110
——— empty packages 106
Returns, absentees and late comers 58
——— arrivals and loads of trains 56
——— delivery of urgent traffic 59
——— departure of outwards trains 60
——— men on duty, cost, overtime, etc. 58
——— number of wagons unloaded hour by hour 60

Digitized by Google

PAGE
Returns, station working, suggested 54, 55, 56
——— traffic and expenses 79–82
——— vans hourly passing out of station 59
——— wagons, sheets, ropes, etc., on hand and required ... 58, 59
——— wagons underload 56
Rubber correspondence stamps 49–50
Rules of small station control 122, 123, 124

SEPARATION OF RETURNED EMPTIES FROM GOODS 106
Sheds, loading and unloading 88
——— suggested corrugated iron 89
Sheets and ropes lying about yard 70, 120
"Shifts," arrangement of 23, 24
Shunters' "bonus," advantages of 22, 23
——— extracts from rule book for 26
Sidings, suggested additional shed 3
Single-entry delivery sheet for returned empties 109
——— system 98, 99, 132
Small stations, control of 118, 119
Stables, daily inspection of 135
Staff, arrangement of outside 4
——— balance with work 5
——— composition of productive 5
——— controller's personal dealings with 63–66
——— duties, callers-off 27
——— ——— checkers 26
——— ——— foremen 15
——— ——— inspectors 17, 18, 19
——— fixing hours of duty 25
——— indoor 40
——— instructions as to duties 26
——— "inwards" and "outwards," 24
——— office, duties of 76
——— productive and non-productive... 5
——— progress of 83
——— punishment of 66–68
——— registration and record of 77
——— regulation of cost of 79
——— ——— in advances of pay 78
——— reporting of accidents to 75
——— return of absentees and latecomers 58
——— suggested instructions to loaders 28–39
Station construction 1
——— ——— alterations in 3
——— daily inspection of 69
——— organisation 1, 2
Stationmasters' responsibilities 119
Statistics receipts and expenditure 138
Substance of letter communications 55

Digitized by Google

PAGE

TEAMS, TURNING OUT CLEAN 134
Test weighing of goods 116, 117
Timekeeping, check upon 76
Tonnage, "handled" and "not handled," 82
——— recording of, for "bonus" purposes 15
Traffic and expenses 79–82
Trains, economy of fully loading 71–72
——— starting to time of 60
Transhipping, the Crewe system explained 153–180
Transporter tables 89
Traverser power cranes 89
Turntables, substitution of curves for 3
Types of loading and unloading sheds 88
Typewriters, invoicing and delivery sheeting 98

UNDERCHARGING WEIGHT OF GOODS 115, 116
"Unentereds," goods 96, 97
——— returned empties 108
Useful station returns 142

VAN GUARDS 135, 136
Vans, cleaning of... 135

WORKING DIFFICULTIES, WANT OF ROOM 85

YARD, SWEEPING OF 71

PRINTED BY NEILL AND CO., LTD., EDINBURGH.

Digitized by Google

RAILWAY BILLING

Underwood Railway Typewriters, worked in conjunction with Underwood Special Systems, have "speeded-up" the whole work of the Goods Departments of many large Companies—by handling the work in less time, with less effort, and greater accuracy. Underwood Railway Typewriters are built specially for their purposes—Extracting, Invoicing, Accounts Work, and Correspondence—with full knowledge of the special requirements in each case.

The Underwood "Simultaneous" Railway Invoicing Machine with 18-in. carriage, showing the Invoice, Carman's Delivery Sheet, and the Consignee's Debit Note, together with the necessary carbon copies, being made at one operation. This Moael is unequalled for Speed, Reliability, and Durability under the hardest conditions.

Underwood Typewriter Co.

120 QUEEN VICTORIA ST., LONDON, E.C.

Digitized by Google

LIMEWASHING CATTLE TRUCKS AND CATTLE PENS WITH AN ALPHA SPRAYER ON THE S. E. & C. R. SYSTEM.

ONE MAN WITH AN ALPHA CAN DO THE WORK OF TEN MEN without effort. He can limewash ten times the area covered by the most expert brush hand, and do it more thoroughly.

The limewash forced from an ALPHA Sprayer in a finely divided spray goes into joints and angles, and cracks and crannies, without such harbours of disease organisms being the subject of special attention on the part of the operator.

THE ALPHA HAS REVOLUTIONIZED LIMEWASHING. It saves money, time, and material, and its work thoroughly satisfies B. O. A. and F. Inspectors.

The fullest particulars can be obtained, and demonstrations arranged for by application to ROBINSON BROS., Ltd., West Bromwich, or their Agents in—

AUSTRALIA: T. A. Warburton, Oxford Chambers, Bourke St., Melbourne.
NEW ZEALAND: J. W. Wallace & Co., Victoria St., Wellington.
SOUTH AFRICA: J. Robinson, Signal Street, Cape Town.
ARGENTINE: Lapeyre & Hanson, Rivadavia 679, Buenos Aires.

Digitized by Google

THE BRITISH COMBINE POLISH CO., Ltd.

CONTRACTORS TO H.M. GOVERNMENT,
The Admiralty, Post Office, Municipal Authorities, Leading Railway Companies, Stores, etc., etc.

Manufacturers of

'VELVALINE,' **'NON-FLAM,'** (Registered)

'SILVERSHINE,'

Revivers and Renovators for Railway Carriages, Tramway Cars, Ships' Interiors, Brass, Gun Metal, Silver, Electro Plate, etc., etc.

SPECIALITY:

RAILWAY CARRIAGE CLEANER AND POLISHER

Guaranteed Non-Inflammable and Non-Poisonous. Contains no Soda, Potash, Petroleum, Volatile Oils, or Injurious Acids.

The British Combine Polish Co.

LTD.

Registered Office: 21 Regent Street, London, W.
Factories: Cornbrook, Manchester,
and 162 Westminster Bridge Road, London, S.E.

Telephone No.: 3940 Gerrard. Teleg. Add.: "YELNOFLAM," LONDON.

Digitized by Google

Each Volume, 3s. net. . . . Post free, 3s. 4d.
Or, complete in 4 Vols., 12s. net. Post free, 12s. 8d.

SPONS'
WORKSHOP RECEIPTS

FOR

MANUFACTURERS AND SCIENTIFIC AMATEURS

NEW AND THOROUGHLY REVISED EDITION

In 4 Volumes, Crown 8vo, Cloth.
Containing 1053 illustrations and 2144 pages.

Vol. I.—ACETYLENE LIGHTING to DRYING:
223 illustrations, 532 pages.
,, II.—DYES AND DYEING to JAPANS AND JAPANNING:
259 illustrations, 540 pages.
,, III.—JOINTING PIPES to PUMPS AND SYPHONS:
250 illustrations, 528 pages.
,, IV.—RAINWATER SEPARATORS to WIRE ROPE SPLICING:
321 illustrations, 540 pages.

"Characterized by thoroughness and up-to-dateness."—IRONMONGER.
"A most handy book for all sorts of men in all parts of the world."—TROPICAL LIFE.
"An excellent production."—PHARMACEUTICAL JOURNAL.
"An old and tried friend."—BUILDING WORLD.
"An exceedingly useful book of reference."—MECHANICAL WORLD.
"The practical man ought to have the whole series on his shelf."—BUILDING WORLD.
"No space is wasted with mere padding."
ILLUSTRATED CARPENTER AND BUILDER.

London: E. & F. N. SPON, Ltd., 57 HAYMARKET
And of all Booksellers throughout the World

Digitized by Google

A SHORT LIST OF
SCIENTIFIC BOOKS

PUBLISHED AND SOLD BY

. & F. N. SPON, Limited,

57 Haymarket, London, S.W.

E ENGLISH AGENTS for the Books of—
MYRON C. CLARK, NEW YORK
SPON & CHAMBERLAIN, NEW YORK

	PAGE
NAUTICS	2
CULTURE	2
ITECTURE	3
LLERY	5
GES AND ROOFS	6
DING	3
NT AND CONCRETE	7
ENGINEERING	9
IONARIES	12
ESTIC ECONOMY	13
WING	14
TRICAL ENGINEERING	15
IGN EXCHANGE	20
AND OIL ENGINES	21
LIGHTING	21
ORICAL; BIOGRAPHICAL	22
OLOGY	23
RAULICS	23
STRIAL CHEMISTRY	25
ITUTIONS	56
REST TABLES	27
GATION	28
RITHM TABLES	29
MANUFACTURES	25
MARINE ENGINEERING	29
MATERIALS	31
MATHEMATICS	31
MECHANICAL ENGINEERING	33
METALLURGY	36
METRIC TABLES	38
MINERALOGY AND MINING	38
MISCELLANEOUS	55
MODEL MAKING	40
MUNICIPAL ENGINEERING	46
NAVAL ARCHITECTURE	29
ORGANISATION	41
PHYSICS	42
PRICE BOOKS	43
RAILWAY ENGINEERING	44
SANITATION	46
STRUCTURAL DESIGN	6
TELEGRAPH CODES	48
WARMING; VENTILATION	48
WATER SUPPLY	49
WORKSHOP PRACTICE	50
USEFUL TABLES	53

All books are bound in cloth unless otherwise stated.

NOTE: The Prices in this Catalogue apply to books sold in the United Kingdom only.

Digitized by Google

AERONAUTICS

The Atmosphere: its characteristics and dynamics. By F. J. B. CORDEIRO. With 35 illus. 129 pp. medium 8vo. (*New York, 1910*) ... ... *net* 10 6

Theory and Practice of Model Aeroplaning. By V. E. JOHNSON. 61 illus. 150 pp. crown 8vo. (*1910*) ... ... *net* 3 6

The Gyroscope, An Experimental Study. By V. E. JOHNSON. 34 illus. 40 pp. crown 8vo, limp. (S. & C. SERIES, No. 22.) (*1911*) ... *net* 1 6

Natural Stability and the Parachute Principle in Aeroplanes. By W. LE MAITRE. 34 illus. 48 pp. crown 8vo. (S. & C. SERIES No. 39.) (*1911*) ... . *net* 1 6

How to Build a 20-ft. Bi-plane Glider. By A. P. MORGAN. 31 illus. 60 pp. crown 8vo, limp. (S. & C. SERIES, No. 14.) (*New York, 1909*) *net* 1 6

Flight-Velocity. By A. SAMUELSON. 4 plates, 42 pp. 8vo, sewed. (*1906*) ... ... *net* 2 0

Resistance of Air and the Question of Flying. By A. SAMUELSON. 23 illus. 36 pp. 8vo, sewed. (*1905*) ... ... *net* 2 0

AGRICULTURE.

Hemp. A Practical Treatise on the Culture for Seed and Fibre. By S. S. BOYCE. 13 illus. 112 pp. crown 8vo. (*New York, 1900*) ... ... *net* 2 0

The Fertilisation of Tea. By G. A. COWIE. With 17 illus. 68 pp. crown 8vo, sewed. (*1908*) *net* 2 6

Farm Drainage. By H. F. FRENCH. 100 illus. 284 pp. crown 8vo. (*New York, 1904*)... ... *net* 4 6

Spices and How to Know Them. By W. M. GIBBS. With 47 plates, including 14 in colours, 179 pp. 8vo. (*New York, 1909*) ... ... *net* 15 0

Talks on Manures. By J. HARRIS. New edition, 366 pp. crown 8vo, (*New York, 1893*) ... *net* 6 6

Digitized by Google

Coffee, its Culture and Commerce in all Countries. By C. G. W. LOCK. 11 plates, 274 pp. crown 8vo. (*1888*) 12 6

Sugar, a Handbook for Planters and Refiners. By the late J. A. R. NEWLANDS and B. E. R. NEWLANDS. 236 illus. 876 pp. demy 8vo. (*1909*) *net* 1 5 0

Hops, their Cultivation, Commerce and Uses. By P. L. SIMMONDS. 143 pp. crown 8vo. (*1877*) ... 4 6

The Future of Cocoa-Planting. By H. HAMEL SMITH. With illustrations, 95 pp. crown 8vo, sewed. (*1908*) ... ... *net* 1 0

Notes on Soil and Plant Sanitation on Cocoa and Rubber Estates. By H. H. SMITH. 108 illustrations, 632 pp. crown 8vo. (*1911*) *net* 10 0

Estate Fences, their Choice, Construction and Cost. By A. VERNON. Re-issue, 150 illus. 420 pp. 8vo. (*1909*) ... ... *net* 8 6

ARCHITECTURE AND BUILDING.

Engineering Work in Public Buildings. By R. O. ALLSOP. 77 illus. 168 pp. demy 4to. (*1912*) ... ... *net* 12 6

The Hydropathic Establishment and its Baths. By R. O. ALLSOP. 8 plates, 107 pp. demy 8vo. (*1891*) 5 0

The Turkish Bath, its Design and Construction. By R. O. ALLSOP. 27 illus. 152 pp. demy 8vo. (*1890*) 6 0

Public Abattoirs, their Planning, Design and Equipment. By R. S. AYLING. 33 plates, 100 pp. demy 4to. (*1908*) ... ... *net* 8 6

The Builder's Clerk. By T. BALES. Second edition, 92 pp. fcap. 8vo. (*1904*) 1 6

Glossary of Technical Terms used in Architecture and the Building Trades. By G. J. BURNS. 136 pp. crown 8vo. (*1895*) 3 6

Chimney Design and Theory. By W. W. CHRISTIE. Second edition, 54 illus. 200 pp. crown 8vo. (*New York, 1902*) ... ... *net* 12 6

Digitized by Google

Approximate Estimates. By T. E. COLEMAN. Third edition, 481 pp. oblong 32mo, leather. (*1907*) ... ... *net* 5 0

Stable Sanitation and Construction. By T. E. COLEMAN. 183 illus. 226 pp. crown 8vo. (*1897*) 6 0

Architectural Examples in Brick, Stone, Wood and Iron. By W. FULLERTON. Third edition 245 plates, 254 pp. demy 4to. (*1908*) ... *net* 15 0

Bricklaying System. By F. B. GILBRETH. Fully illustrated, 321 pp. 8vo. (*New York, 1909*) *net* 12 6

Field System. By F. B. GILBRETH. 194 pp. 12mo. leather. (*New York, 1908*) ... ... *net* 12 6

The Building Trades Pocket Book. Compiled by R. HALL. 12mo. With interchangeable diary. *net* 1 0

The Clerk of Works' Vade Mecum. By G. G. HOSKINS. Seventh edition, 52 pp. fcap. 8vo. (*1901*) 1 6

Paint and Colour Mixing. By A. S. JENNINGS. Fourth edition, 14 coloured plates, 190 pp. 8vo. (*1910*) ... ... *net* 5 0

A Handbook of Formulæ, Tables, and Memoranda, for Architectural Surveyors and others engaged in Building. By J. T. HURST. Fifteenth edition, 512 pp. royal 32mo, roan. (*1905*) *net* 5 0

Quantity Surveying, for the use of Surveyors, Architects, Engineers, and Builders. By J. LEANING. Fifth edition, 936 pp. demy 8vo. (*1904*) ... ... *net* 1 5 0

Builders' Quantities. By H. M. LEWIS. 6 illus. 44 pp. crown 8vo. (S. & C. SERIES No. 40.) (*1911*) *net* 1 6

Obstruction to Light. A Graphic Method of determining Problems of Ancient Lights. By H. B. MOLESWORTH. 9 folding plates, 4to. (*1902*) *net* 6 0

Suburban Houses. A series of practical plans. By J. H. PEARSON. 46 plates and 12 pp. text, crown 4to. (*1905*) ... ... *net* 7 6

Solid Bitumens, their Physical and Chemical Properties and Chemical Analysis. By S. F. PECKHAM. 23 illus. 324 pp. 8vo. (*New York, 1909*) 1 1 0

Digitized by Google

Roman Architecture, Sculpture and Ornament. By G. B. PIRANESI. 200 plates, reproduced in facsimile from the original. 2 vols. imperial folio, in wrappers. (*1900*) ... ... *net* 2 2 0

The Seven Periods of English Architecture, defined and illustrated. By E. SHARPE. Third edition, 20 steel plates, royal 8vo. (*1888*) ... 12 6

Our Factories, Workshops and Warehouses, their Sanitary and Fire-Resisting Arrangements. By B. H. THWAITE. 183 illus. 282 pp. crown 8vo. (*1882*) 9 0

Elementary Principles of Carpentry. By T. TREDGOLD and J. T. HURST. Eleventh edition, 48 plates, 517 pp. crown 8vo. (*1904*) 12 6

Treatise on the Design and Construction of Mill Buildings. By W. G. TYRRELL. 652 illus. 490 pp. demy 8vo. (*New York, 1911*) ... *net* 17 0

Practical Stair Building and Handrailing. By W. H. WOOD. 32 plates, 91 pp. crown 4to. (*1894*) 10 6

Spons' Architects' and Builders' Pocket Price-Book, Memoranda, Tables and Prices. Edited by CLYDE YOUNG. Revised by STANFORD M. BROOKS. 16mo, leather cloth (size 6½ in. by 3¾ in. by ½ in. thick). Issued annually in two Sections.

PRICES AND DIARY, in green cover, 239 pp. with Diary showing a week at an opening *net* 2 6

MEMORANDA AND TABLES, in red cover. Illustrated, 372 pp. ... ... *net* 2 6

Heating Engineers' Quantities. By W. L. WHITE and G. M. WHITE. 4 plates, 33 pp. folio. (*1910*) *net* 10 6

ARTILLERY.

Guns and Gun Making Material. By G. EDE. Crown 8vo. (*1889*) 6 0

Treatise on Application of Wire to Construction of Ordnance. By J. A. LONGRIDGE. 180 pp. 8vo. (*1884*) 1 5 0

Digitized by Google

The Progress of Artillery: Naval Guns. By J. A. LONGRIDGE. 8vo, sewed. (*1896*)... ... ... 2 0

The Field Gun of the Future. By J. A. LONGRIDGE. 8vo, sewed. (*1892*) 2 6

BRIDGES, ARCHES, ROOFS, AND STRUCTURAL DESIGN.

Strains in Ironwork. By HENRY ADAMS. Fourth edition, 8 plates, 65 pp. crown 8vo. (*1904*) ... 5 0

Designing Ironwork. By HENRY ADAMS. Second series. 8vo, sewed.

Part I. A Steel Box Girder. (*1894*) *net* 0 9
,, II. Built-up Steel Stanchions. (*1901*)*net* 1 3
,, III. Cisterns and Tanks. (*1902*) *net* 1 0
,, IV. A Fireproof Floor. (*1903*) *net* 1 0

Columns and Struts. Theory and Design. By WM. ALEXANDER. 101 illus., xii + 265 pp. demy 8vo. (*1912*) ... ... *net* 10 6

A Practical Treatise on Segmental and Elliptical Oblique or Skew Arches. By G. J. BELL. Second edition, 17 plates, 125 pp. royal 8vo. (*1906*) ... ... *net* 1 1 0

Economics of Construction in relation to Framed Structures. By R. H. BOW. Third thousand, 16 plates, 88 pp. 8vo. (*1873*) 5 0

Theory of Voussoir Arches. By Prof. W. CAIN. Third edition, 201 pp. 18mo, boards. (*New York, 1905*) ... ... *net* 2 0

New Formulæ for the Loads and Deflections of Solid Beams and Girders. By W. DONALDSON. Second edition, 8vo. (*1872*) 4 6

Plate Girder Railway Bridges. By M. FITZMAURICE. 4 plates, 104 pp. 8vo. (*1895*) 6 0

Pocket Book of Calculations in Stresses. By E. M. GEORGE. 66 illus. 140 pp. royal 32mo, half roan. (*1895*)... ... ... 3 6

Strains on Braced Iron Arches and Arched Iron Bridges. By A. S. HEAFORD. 39 pp. 8vo. (*1883*) 6 0

Digitized by Google

Tables for Roof Framing. By G. D. INSKIP. Second edition, 451 pp. 8vo, leather. (*New York, 1905*) ... ... *net* 12 6

Stresses in Girder and Roof Frames, for both dead and live loads, by simple Multiplication, etc. By F. R. JOHNSON. 28 plates, 215 pp. crown 8vo. (*1894*) 6 0

A Graphical Method for Swing Bridges. By B. F. LA RUE. 4 plates, 104 pp. 18mo, boards. (*New York, 1892*) ... ... *net* 2 0

Notes on Cylinder Bridge Piers and the Well System of Foundations. By J. NEWMAN. 144 pp. 8vo. (*1893*) 6 0

Calculation of Columns. By T. NIELSEN. 4 plates, 36 pp. 8vo. cloth. (*1911*) ... ... *net* 4 6

A New Method of Graphic Statics applied in the Construction of Wrought Iron Girders. By E. OLANDER. 16 plates, small folio. (*1887*) ... 10 6

Steel Bar and Plate Tables. Giving Weight of a Lineal Foot of all sizes of L and T Bars, Flat Bars, Plates, Square and Round Bars. By E. READ. On large folding card. (*1911*) ... *net* 1 0

Reference Book for Statical Calculations. By F. RUFF. With diagrams, 140 pp. crown 8vo. (*1906*) ... ... *net* 5 0

Suspension Bridges and Cantilevers. By D. B. STEINMANN. (VAN NOSTRAND SERIES, No. 127.) (*New York, 1911.*) ... ... *net* 2 0

The Strength and Proportion of Riveted Joints. By B. B. STONEY. 87 pp. 8vo. (*1885*) 5 0

The Anatomy of Bridgework. By W. H. THORPE. 103 illus. 190 pp. crown 8vo. (*1906*) ... *net* 6 0

CEMENT AND CONCRETE.

Portland Cement: its Manufacture, Testing and Use. By D. B. BUTLER. Second edition, 97 illus. 396 pp. demy 8vo. (*1905*) ... ... *net* 16 0

Theory of Steel-Concrete Arches and of Vaulted Structures. By W. CAIN. Fourth edition, 27 illus. 212 pp. 18mo, boards. (*New York, 1906*) *net* 2 0

Digitized by Google

Reinforced Concrete Construction. Elementary Course. By M. T. CANTELL. 65 illus. 135 pp. crown 8vo. (*1911.*) ... ... *net* 4 6

Graphical Reinforced Concrete Design. A series of Diagrams on sheets (measuring 17½ in. by 22½ in.) for Designing and Checking. With 48-page pamphlet. By J. A. DAVENPORT. Complete in roll. (*1911*) ... ... *net* 5 0

Cement Users' and Buyers' Guide. By CALCARE. 115 pp. 32mo, cloth. (*1901*) ... ... *net* 1 6

Diagrams for Designing Reinforced Concrete Structures. By G. F. DODGE. 31 illus. 104 pp. oblong folio. (*New York, 1910*) ... ... *net* 17 0

Cements, Mortars, and Concretes; their Physical properties. By M. S. FALK. 78 illus. 176 pp. 8vo. (*New York, 1904*) ... ... *net* 10 6

Concrete Construction, Methods and Cost. By H. P. GILLETTE and C. S. HILL. 310 illus. 690 pp. 8vo. (*New York, 1908*) ... ... *net* 1 1 0

Engineers' Pocket-Book of Reinforced Concrete. By E. L. HEIDENREICH. 164 illus. 364 pp. crown 8vo, leather, gilt edges. (*New York, 1909*) *net* 12 6

Concrete Inspection. By C. S. HILL. 15 illus. 179 pp. 12mo. (*New York, 1909*) ... ... *net* 4 6

Practical Silo Construction. By A. A. HOUGHTON. 18 illus. 69 pp. crown 8vo. (S. & C. SERIES, No. 27.) (*New York, 1911*) ... ... *net* 1 6

Molding Concrete Chimneys, Slate and Roof Tiles. By A. A. HOUGHTON. 15 illus. 61 pp. crown 8vo. (S. & C. SERIES, No. 28.) (*New York, 1911*) ... ... *net* 1 6

Molding and Curing Ornamental Concrete. By A. A. HOUGHTON. 5 illus. 58 pp. crown 8vo. (S. & C. SERIES, No. 29.) (*New York, 1911*) *net* 1 6

Concrete Monuments, Mausoleums and Burial Vaults. By A. A. HOUGHTON. 18 illus. 65 pp. crown 8vo. (S. & C. SERIES, No. 31.) (*New York, 1911*) ... ... *net* 1 6

Concrete Floors and Sidewalks. By A. A. HOUGHTON. 8 illus. 63 pp. crown 8vo. (S. & C. SERIES, No. 32.) (*New York, 1911*) ... *net* 1 6

Digitized by Google

Molding Concrete Baths, Tubs, Aquariums and Natatoriums. By A. A. HOUGHTON. 16 illus. 64 pp. crown 8vo. (S. & C. SERIES, No. 33.) (*New York, 1911*) ... ... *net* 1 6

Reinforced Concrete. By E. MCCULLOCH. 28 illus. 128 pp. crown 8vo. (*New York, 1908*) *net* 6 6

Concrete and Reinforced Concrete. By H. A. REID. 715 illus. 884 pp. royal 8vo. (*New York, 1907*) ... ... *net* 21 0

Theory and Design of Reinforced Concrete Arches. By A. REUTERDAHL. 41 illus. 126 pp. 8vo. (*New York, 1908*) ... ... *net* 8 6

Specification for Concrete Flags. Issued by the INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS. Folio, sewed. (*1911*) ... ... *net* 2 6

Practical Cement Testing. By W. P. TAYLOR. With 142 illus. 329 pp. demy 8vo. (*New York, 1906*) ... ... *net* 12 6

Concrete Bridges and Culverts. By H. G. TYRRELL. 66 illus. 251 pp. crown 8vo, leather *net* 12 6

CIVIL ENGINEERING.

CANALS, SURVEYING.

(*See also* IRRIGATION *and* WATER SUPPLY.)

Practical Hints to Young Engineers Employed on Indian Railways. By A. W. C. ADDIS. With 14 illus. 154 pp. 12mo. (*1910*) ... *net* 3 6

Levelling, Barometric, Trigonometric and Spirit. By I. O. BAKER. Second edition, 15 illus. 145 pp. 18mo, boards. (*New York, 1903*) ... *net* 2 0

Punjab Rivers and Works. By E. S. BELLASIS. 47 illus. 85 pp. folio, cloth. (*1911*) ... *net* 8 0

Notes on Instruments best suited for Engineering Field Work in India and the Colonies. By W. G. BLIGH. 65 illus. 218 pp. 8vo. (*1899*) ... 7 6

Practical Designing of Retaining Walls. By Prof. W. CAIN. Fifth edition, 14 illus. 172 pp. 18mo, boards. (*New York, 1908*) ... ... *net* 2 0

Digitized by Google

Land Area Tables. By W. CODD. Sheet mounted on linen in cloth case and explanatory booklet ... 3 6

The Maintenance of Macadamised Roads. By T. CODRINGTON. Second edition, 186 pp. 8vo. (*1892*) 7 6

The Civil Engineers' Cost Book. By MAJOR T. E. COLEMAN, R.E. xii. + 289 pp. Pocket size ($6\frac{1}{2}$ in × $3\frac{5}{8}$ in.), leather cloth with rounded corners. (*1912*) ... ... *net* 5 0

Retaining Walls in Theory and Practice. By T. E. COLEMAN. 104 illus. 160 pp. crown 8vo. (*1909*) ... ... *net* 5 0

The Barometrical Determination of Heights. By F. J. B. CORDEIRO. Crown 8vo, limp leather. (*New York, 1898*) ... ... *net* 4 6

On Curved Masonry Dams. By W. B. COVENTRY. 8vo, sewed. (*1894*) 2 0

A Practical Method of Determining the Profile of a Masonry Dam. By W. B. COVENTRY. 8vo, sewed. (*1894*) 2 6

The Stresses on Masonry Dams (oblique sections). By W. B. COVENTRY. 8vo, sewed. (*1894*) ... 2 0

Tables for facilitating the Calculation of Earthworks. By D. CUNNINGHAM. 120 pp. royal 8vo . 10 6

Handbook of Cost Data for Contractors and Engineers. By H. P. GILLETTE. 1854 pp. crown 8vo, leather, gilt edges. (*New York, 1910*) *net* 1 1 0

Rock Excavation, Methods and Cost. By H. P. GILLETTE. 56 illus. 376 pp. crown 8vo. (*New York, 1904*) ... ... *net* 12 6

High Masonry Dams. By E. S. GOULD. With illus. 88 pp. 18mo, boards. (*New York, 1897*) *net* 2 0

Grace's Tables for Curves, with hints to young engineers. 8 figures, 43 pp. oblong 8vo. (*1908*) *net* 5 0

Grace's Earthwork Tables. 36 double-page tables, 4to. (*1907*) ... ... *net* 12 6

Railway Tunnelling in Heavy Ground. By C. GRIPPER. 3 plates, 66 pp. royal 8vo. (*1879*) ... 7 6

Digitized by Google

Levelling and its General Application. By T. HOLLOWAY. Second edition, 53 illus. 147 pp. 8vo. (*1895*)... ... ... 5 0

Waterways and Water Transport in different Countries. By J. S. JEANS. 55 illus. 520 pp. 8vo. (*1890*) ... ... *net* 9 0

Table of Barometrical Heights to 20,000 Feet. By W. H. MACKESY, with some practical suggestions by Sir Guilford Molesworth. 1 plate, 24 pp. royal 32mo. (*1882*) 3 0

Aid Book to Engineering Enterprise. By E. MATHESON. Third edition, illustrated, 916 pp. medium 8vo, buckram. (*1898*) 1 4 0

A Treatise on Surveying. By R. E. MIDDLETON and O. CHADWICK. Third edition, royal 8vo. (*1911*)
Part I. 11 plates 162 illus. 285 pp. 10 6
„ II. 152 illus. and 2 plates, 340 pp. ... 10 6

A Pocket Book of Useful Formulæ and Memoranda, for Civil and Mechanical Engineers. By Sir G. L. MOLESWORTH and H. B. MOLESWORTH. With an Electrical Supplement by W. H. MOLESWORTH. Twenty-sixth edition, 760 illus. 901 pp. royal 32mo, French morocco, gilt edges. (*1908*) *net* 5 0

The Pocket Books of Sir G. L. Molesworth and J. T. Hurst, printed on India paper and bound in one vol. Royal 32mo, russia, gilt edges *net* 10 6

Metallic Structures: Corrosion and Fouling and their Prevention. By J. NEWMAN. Illustrated, 385 pp. crown 8vo. (*1896*)... ... ... 9 0

Scamping Tricks and Odd Knowledge occasionally practised upon Public Works. By J. NEWMAN. New impression, 129 pp. crown 8vo. (*1908*) *net* 2 0

Earthwork Slips and Subsidences on Public Works. By J. NEWMAN. 240 pp. crown 8vo. (*1890*) 7 6

Co-ordinate Geometry as applied to Land Surveying. By W. PILKINGTON. 5 illus. 44 pp. 12mo. (*1909*) ... ... *net* 1 6

Diagrams for the Graphic Calculation of Earthwork Quantities. By A. H. ROBERTS. Ten cards, fcap. in cloth case ... ... *net* 10 6

Digitized by Google

Pioneering. By F. SHELFORD, illustrated. 88 pp. crown 8vo. (*1909*) ... ... *net* 3 0

Topographical Surveying. By G. J. SPECHT. Second edition, 2 plates and 28 illus. 210 pp. 18mo, boards. (*New York, 1898*) ... ... *net* 2 0

Spons' Dictionary of Engineering, Civil, Mechanical, Military and Naval. 10,000 illus. 4300 pp. super royal 8vo. (*1874, Supplement issued in 1881*).
Complete with Supplement, in 11 divisions *net* 3 10 0
Ditto ditto in 4 vols. ... ... *net* 3 3 0

Surveying and Levelling Instruments. By W. F. STANLEY. Third edition, 372 illus. 562 pp. crown 8vo. (*1901*) 7 6

Surveyor's Handbook. By T. U. TAYLOR. 116 illus. 310 pp. crown 8vo, leather, gilt edges. (*New York, 1908*) ... ... *net* 8 6

Logarithmic Land Measurement. By J. WALLACE. 32 pp. royal 8vo. (*1910*) ... ... *net* 5 0

The Drainage of Fens and Low Lands by Gravitation and Steam Power. By W. H. WHEELER. 8 plates, 175 pp. 8vo. (*1888*) ... 12 6

Stadia Surveying, the theory of Stadia Measurements. By A. WINSLOW. Fifth edition, 148 pp. 18mo, boards. (*New York, 1902*) ... ... *net* 2 0

Handbook on Tacheometrical Surveying. By C. XYDIS. 55 illus. 3 plates, 63 pp. 8vo. (*1909*) *net* 6 0

DICTIONARIES.

Technological Dictionary in the English, Spanish, German and French Languages. By D. CARLOS HUELIN Y ARSSU. Crown 8vo.
Vol. I. ENGLISH-SPANISH-GERMAN-FRENCH. 609 pp. (*1906*) ... ... *net* 10 6
Vol. II. GERMAN-ENGLISH-FRENCH-SPANISH. 720 pp. (*1908*) ... ... *net* 10 6
Vol. III. FRENCH-GERMAN-SPANISH-ENGLISH. *In preparation.*
Vol. IV. SPANISH-FRENCH-ENGLISH-GERMAN. 750 pp. (*1910*) ... ... *net* 10 6

Digitized by Google

Dictionary of English and Spanish Technical and Commercial Terms. By W. JACKSON. 164 pp. fcap. 8vo. (*1911*) ... ... *net* 2 6

English-French and French-English Dictionary of the Motor-Car, Cycle and Boat. By F. LUCAS. 171 pp. crown 8vo. (*1905*) ... *net* 2 0

Spanish-English Dictionary of Mining Terms. By F. LUCAS. 78 pp. 8vo. (*1905*) ... *net* 5 0

English-Russian and Russian-English Engineering Dictionary. By L. MEYCLIAR. 100 pp. 16mo. (*1909*) ... ... *net* 2 6

Reed's Polyglot Guide to the Marine Engine, in English, French, German and Norsk. Second edition, oblong 8vo. (*1900*). ... ... *net* 6 0

DOMESTIC ECONOMY.

Food Adulteration and its Detection. By J. P. BATTERSHALL. 12 plates, 328 pp. demy 8vo. (*New York, 1887*) 15 0

How to Check Electricity Bills. By S. W. BORDEN. 41 illus. 54 pp. crown 8vo. (*New York, 1907*) ... ... *net* 2 0

Practical Hints on Taking a House. By H. P. BOULNOIS. 71 pp. 18mo. (*1885*) 1 6

The Cooking Range, its Failings and Remedies. By F. DYE. 52 pp. fcap. 8vo, sewed. (*1888*) ... 0 6

Spices and How to Know Them. By W. M. GIBBS. With 47 plates, including 14 in colours, 179 pp. 8vo. (*New York, 1909*) ... ... *net* 15 0

The Kitchen Boiler and Water Pipes. By H. GRIMSHAW. 8vo, sewed. (*1887*) ... ... *net* 1 0

Cookery and Domestic Management, including economic and middle class Practical Cookery. By K. MELLISH. 56 coloured plates and 441 illus. 987 pp. super-royal 8vo. (*1901*) ... *net* 16 0

Spons' Household Manual. 250 illus. 1043 pp. demy 8vo. (*1902*) 7 6

Ditto ditto half-bound French morocco 9 0

Handbook of Sanitary Information for Householders. By R. S. TRACY. 33 illus. 114 pp. 18mo. (*New York, 1900*) 2 6

Digitized by Google

DRAWING.

The Ornamental Penman's, Engraver's and Sign Writer's Pocket Book of Alphabets. By B. ALEXANDER. Oblong 12mo, sewed 0 6

Slide Valve Diagrams: a French Method for their Construction. By L. BANKSON. 18mo, boards. (*New York, 1892*) ... ... *net* 2 0

A System of Easy Lettering. By J. H. CROMWELL. With Supplement by G. MARTIN. Eleventh edition, 36 pp. oblong 8vo. (*New York, 1911*) *net* 2 0

Key to the Theory and Methods of Linear Perspective. By C. W. DYMOND, F.S.A. 6 plates, 32 pp. crown 8vo, limp. (S. & C. SERIES, No. 20.) (*1910*) ... ... *net* 1 6

Plane Geometrical Drawing. By R. C. FAWDRY. Illustrated, 185 pp. crown 8vo. (*1901*) ... *net* 3 0

Twelve Plates on Projection Drawing. By O. GUETH. Oblong 4to. (*New York, 1903*) ... *net* 3 0

Hints on Architectural Draughtsmanship. By G. W. T. HALLATT. Fourth edition, 80 pp. 18mo. (*1906*) ... ... *net* 1 6

A First Course of Mechanical Drawing (Tracing). By G. HALLIDAY. Oblong 4to, sewed 2 0

A Text-Book of Graphic Statics. By C. W. MALCOLM. 155 illus. 316 pp. 8vo. (*New York, 1909*) ... ... *net* 12 6

Drawings for Medium-sized Repetition Work. By R. D. SPINNEY. With 47 illus. 130 pp. 8vo. (*1909*) ... ... *net* 3 6

Mathematical Drawing Instruments. By W. F. STANLEY. Seventh edition, 265 illus. 370 pp. crown 8vo. (*1900*) 5 0

The Backbone of Perspective. By T. M. TAYLOR. 40 illus. 56 pp. 18mo cloth. (*New York, 1911*) *net* 4 6

Digitized by Google

ELECTRICAL ENGINEERING.

Practical Electric Bell Fitting. By F. C. ALLSOP. Tenth edition, 186 illus. including 8 folding plates, 185 pp. crown 8vo. (*1903*) 3 6

Telephones: their Construction and Fitting. By F. C. ALLSOP. Eighth edition, 184 illus. 222 pp. crown 8vo. (*1909*) ... ... *net* 3 6

Thermo-electric Reactions and Currents between Metals in Fused Salts. By T. ANDREWS. 8vo, sewed. (*1896*) 1 0

Auto-Transformer Design. By A. H. AVERY. 25 illus. 60 pp. 8vo. (*1909*) ... ... *net* 3 6

Principles of Electric Power (Continuous Current) for Mechanical Engineers. By A. H. BATE. 63 illus. 204 pp. crown 8vo. (*1905*) (FINSBURY TECHNICAL MANUAL) ... ... *net* 4 6

Practical Construction of Electric Tramways. By WILLIAM R. BOWKER. 93 illus. 119 pp. 8vo. (*1903*) ... ... *net* 6 0

Electrical Ignition for Internal Combustion Engines. By M. A. CODD. 109 illus. 163 pp. crown 8vo. (*1911*) ... ... *net* 3 0

Design and Construction of Induction Coils. By A. F. COLLINS. 155 illus. 272 pp. demy 8vo. (*New York, 1909*) ... ... *net* 12 6

Switchboard Measuring Instruments for Continuous and Polyphase Currents. By J. C. CONNAN. 117 illus. 150 pp. 8vo, cloth. (*1908*) *net* 5 0

Electric Cables, their Construction and Cost. By D. COYLE and F. J. O. HOWE. With many diagrams and 216 tables, 466 pp. crown 8vo, leather. (*1909*) ... ... *net* 15 0

Management of Electrical Machinery. By F. B. CROCKER and S. S. WHEELER. Eighth edition, 131 illus. 223 pp. crown 8vo. (*New York, 1909*) *net* 4 6

Digitized by Google

Electric Lighting: A Practical Exposition of the Art. By F. B. CROCKER. Royal 8vo. (*New York.*)
Vol. I. **The Generating Plant.** Sixth edition, 213 illus. 470 pp. (*1904*) *net* 12 6
Vol. II. **Distributing Systems and Lamps.** Second edition, 391 illus. 505 pp. (*1905*) ... ... *net* 12 6

The Care and Management of Ignition Accumulators. By H. H. U. CROSS. 12 illus. 74 pp. crown 8vo, limp. (S. & C. SERIES, No. 19.) (*1910*) ... ... *net* 1 6

Elements of Telephony. By A. CROTCH. 51 illus. 90 pp. crown 8vo. limp. (S. & C. SERIES, No. 21.) (*1911*) 1 6

Elementary Telegraphy and Telephony. By ARTHUR CROTCH. 238 illus. 223 pp. 8vo. (FINSBURY TECHNICAL MANUAL.) (*1903*) ... *net* 4 6

Electricity and Magnetism in Telephone Maintenance. By G. W. CUMMINGS. 45 illus. 137 pp. 8vo. (*New York, 1908*) ... ... *net* 6 6

Grouping of Electric Cells. By W. F. DUNTON. 4 illus. 50 pp. fcap. 8vo. (*1906*) ... ... *net* 1 6

Wireless Telegraphy for Intending Operators. By C. K. P. EDEN. 20 illus. 80 pp. crown 8vo. limp. (S. & C. SERIES, No. 24.) *In preparation.*

Magnets and Electric Currents. By Prof. J. A. FLEMING. Second edition, 136 illus. 417 pp. crown 8vo (*1902*) ... ... *net* 5 0

Notes on Design of Small Dynamo. By GEORGE HALLIDAY. Second edition, 8 plates, 8vo. (*1895*) 2 6

Practical Alternating Currents and Power Transmission. By N. HARRISON. 172 illus. 375 pp. crown 8vo. (*New York, 1906*) ... *net* 10 6

Making Wireless Outfits. By N. HARRISON. 27 illus. 61 pp. crown 8vo, limp. (S. & C. SERIES, No. 11.) (*New York, 1909*) ... ... *net* 1 6

Wireless Telephone Construction. By N. HARRISON. 43 illus. 73 pp. crown 8vo, limp. (S. & C. SERIES, No. 12.) (*New York, 1909*) ... *net* 1 6

Digitized by Google

Testing Telegraph Cables. By Colonel V. Hoskiœr. Third edition, crown 8vo. (*1889*) ... 4 6

Long Distance Electric Power Transmission. By R. W. Hutchinson. 136 illus. 345 pp. crown 8vo. (*New York, 1907*) ... ... *net* 12 6

Theory and Practice of Electric Wiring. By W. S. Ibbetson. 119 illus. 366 pp. crown 8vo. (*1909*) ... ... *net* 5 0

Practical Electrical Engineering for Elementary Students. By W. S. Ibbetson. With 61 illus. 155 pp. crown 8vo. (*1910*) ... ... *net* 3 6

Form of Model General Conditions recommended by The Institution of Electrical Engineers for use in connection with Electrical Contracts. 8vo, sewed. (*1906*) ... ... *net* 1 0

Telegraphy for Beginners. By W. H. Jones. 19 illus. 58 pp. crown 8vo. (*New York, 1910*) *net* 2 0

A Handbook of Electrical Testing. By H. R. Kempe. Seventh edition, 285 illus. 706 pp. demy 8vo. (*1908*) ... ... *net* 18 0

How to Become a Competent Motorman. By V. B. Livermore and J. Williams. 45 illus. 252 pp. 12mo. (*New York, 1903*) ... ... *net* 4 6

Electromagnets, their design and construction. By A. N. Mansfield. 36 illus. 155 pp. 18mo, boards. (*New York, 1901*) ... ... *net* 2 0

Telephone Construction, Methods and Cost. By C. Mayer. With Appendices on the cost of materials and labour by J. C. Slippy. 103 illus. 284 pp. crown 8vo. (*New York, 1908*) ... *net* 12 6

Storage Batteries, Stationary and Portable. By J. P. Niblett. 22 illus. 80 pp. crown 8vo. (*New York, 1911*) ... ... *net* 2 6

Practical Electrics: a Universal Handybook on Every Day Electrical Matters. Seventh edition, 126 illus. 135 pp. 8vo. (S. & C. Series, No. 13.) (*New York, 1902*) ... ... *net* 1 6

The Voltaic Accumulator: an elementary treatise. By E. Reynier. Translated from the French by J. A. Berly. 62 illus. 202 pp. 8vo 9 0

Digitized by Google

Electroplating. By H. C. REETZ. 62 illus. 99 pp. crown 8vo. (*New York, 1911*) ... ... *net* 2 0

Wiring Houses for the Electric Light. By N. H. SCHNEIDER. 40 illus. 85 pp. crown 8vo, limp. (S. & C. SERIES, No. 25.) (*New York, 1911*) *net* 1 6

Induction Coils. By N. H. SCHNEIDER. Second edition, 79 illus. 285 pp. crown 8vo. (*New York, 1901*) ... ... *net* 4 6

Electric Gas Lighting. By N. H. SCHNEIDER. 57 illus. 101 pp. 12mo. (S. & C. SERIES, No. 8.) (*New York, 1901*) ... ... *net* 2 0

How to Install Electric Bells, Annunciators and Alarms. By N. H. SCHNEIDER. 59 illus. 63 pp. crown 8vo, limp. (S. & C. SERIES, No. 2.) (*New York, 1905*) ... ... *net* 1 6

Modern Primary Batteries, their construction, use and maintenance. By N. H. SCHNEIDER. 54 illus. 94 pp. crown 8vo, limp. (S. & C. SERIES, No. 1.) (*New York, 1905*) ... ... *net* 1 6

Practical Engineers' Handbook on the Care and Management of Electric Power Plants. By N. H. SCHNEIDER. 203 illus. 274 pp. crown 8vo. (*New York, 1906*) ... ... *net* 5 0

Electrical Circuits and Diagrams, illustrated and explained. By N. H. SCHNEIDER. 8vo, limp. (S. & C. SERIES, Nos. 3 and 4.) (*New York*)

Part 1. 217 illus. 72 pp. (*1905*) ... *net* 1 6
Part 2. 73 pp. (*1909*) ... ... *net* 1 6

Electrical Instruments and Testing. By N. H. SCHNEIDER. Third edition. 133 illus. 239 pp. crown 8vo. (*New York, 1907*) ... ... *net* 4 6

Experimenting with Induction Coils. By N. H. SCHNEIDER. 26 illus. 73 pp. crown 8vo, limp. (S. & C. SERIES, No. 5.) (*New York, 1906*) *net* 1 6

Study of Electricity for Beginners. By N. H. SCHNEIDER. 54 illus. 88 pp. crown 8vo, limp. (S. & C. SERIES, No. 6.) (*New York, 1905*) *net* 1 6

Wiring Houses for the Electric Light: Low Voltage Battery Systems. 44 illus. 86 pp. crown 8vo, cloth. (S. & C. SERIES, No. 25.) (*New York, 1911*) ... ... *net* 1 6

Digitized by Google

Low Voltage Electric Lighting with the Storage Battery. By N. H. SCHNEIDER. 23 illus. 85 pp. crown 8vo, cloth. (S. & C. SERIES, No. 26.) (*New York, 1911*) ... ... *net* 1 6

Dry Batteries: how to Make and Use them. By a DRY BATTERY EXPERT. With additional notes by N. H. SCHNEIDER. 30 illus. 59 pp. crown 8vo, sewed. (S. & C. SERIES, No. 7.) (*New York, 1905*) ... ... *net* 1 6

The Diseases of Electrical Machinery. By E. SCHULZ. Edited, with a Preface, by Prof. S. P. THOMPSON. 42 illus. 84 pp. crown 8vo *net* 2 0

Electricity Simplified. By T. O. SLOANE. Tenth edition, 29 illus. 158 pp. crown 8vo. (*New York, 1901*) ... ... *net* 4 6

How to become a Successful Electrician. By T. O. SLOANE. Third edition, illustrated, crown 8vo. (*New York, 1899*) ... ... *net* 4 6

Electricity: its Theory, Sources and Applications. By J. T. SPRAGUE. Third edition, 109 illus. 658 pp. crown 8vo (*1892*) ... ... *net* 7 6

Telegraphic Connections. By C. THOM and W. H. JONES. 20 plates, 59 pp. oblong 8vo. (*New York, 1892*) ... ... *net* 3 6

Dynamo Electric Machinery. By Prof. S. P. THOMPSON. Seventh edition, demy 8vo. (FINSBURY TECHNICAL MANUAL.)

Vol. I. **Continuous-Current Machinery.** With 4 coloured and 30 folding plates, 573 illus. 984 pp. (*1904*) *net* 1 10 0

Vol. II. **Alternating Current Machinery.** 15 coloured and 24 folding plates, 546 illus. 900 pp. (*1905*) *net* 1 10 0

Design of Dynamos (Continuous Currents). By Prof. S. P. THOMPSON. 4 coloured and 8 folding plates, 243 pp. demy 8vo. (*1903*) ... ... *net* 12 0

Schedule for Dynamo Design, issued with the above. 6*d.* each, 4*s.* per doz., or 18*s.* per 100 *net*

Digitized by Google

Curves of Magnetic Data for Various Materials. A reprint on transparent paper for office use of Plate I from Dynamo Electric Machinery, and measuring 25 in. by 16 in. ... ... *net* 0

The Electromagnet. By C. R. UNDERHILL. 67 illus. 159 pp. crown 8vo. (*New York, 1903*) *net* 6

Practical Guide to the Testing of Insulated Wires and Cables. By H. L. WEBB. Fifth edition, 38 illus. 118 pp. crown 8vo. (*New York, 1902*) ... ... *net* 4

Wiring Rules. With Extracts from the Board of Trade Regulations and the Home Office Regulations for Factories and Workshops. Issued by **The Institution of Electrical Engineers.** Sixth edition, 42 pp. 8vo, sewed. (*1911*) *net* 0

FOREIGN EXCHANGE.

English Prices with Russian Equivalents (at Fourteen Rates of Exchange). English prices per lb., with equivalents in roubles and kopecks per pood. By A. ADIASSEWICH. 182 pp. fcap. 32mo, roan. (*1908*)... ... ... *net* 1

English Prices with German Equivalents (at Seven Rates of Exchange). English prices per lb., with equivalents in marks per kilogramme. By St. KOCZOROWSKI. 95 pp. fcap. 32mo, roan. (*1909*) ... ... *net* 1

English Prices with Spanish Equivalents. At Seven Rates of Exchange. English prices per lb., with equivalents in pesetas per kilogramme. By S. LAMBERT. 95 pp. 32mo, roan. (*1910*) *net* 1

English Prices with French Equivalents (at Seven Rates of Exchange). English prices per lb. to francs per kilogramme. By H. P. MCCARTNEY. 97 pp. 32mo, roan. (*1907*) *net* 1

Principles of Foreign Exchange. By E. MATHESON. Fourth edition, 54 pp. 8vo, sewed. (*1905*) *net* 0

Digitized by Google

GAS AND OIL ENGINES.

The Theory of the Gas Engine. By D. CLERK. Edited by F. E. IDELL. Third edition, 19 illus. 180 pp. 18mo, boards. (*New York, 1903*) ... *net* 2 0

Electrical Ignition for Internal Combustion Engines. By M. A. CODD. 109 illus. 163 pp. crown 8vo. (*1911.*) ... ... *net* 3 0

The Design and Construction of Oil Engines. By A. H. GOLDINGHAM. Third edition, 112 illus. 260 pp. crown 8vo. (*New York, 1910*) *net* 10 6

Gas Engine in Principle and Practice. By A. H. GOLDINGHAM. 107 illus. 195 pp. 8vo, cloth. (*New York, 1907*) ... ... *net* 6 6

Practical Hand-Book on the Care and Management of Gas Engines. By G. LIECKFELD. Third edition, square 16mo. (*New York, 1896*) ... 3 6

Elements of Gas Engine Design. By S. A. MOSS. 197 pp. 18mo, boards. (*New York, 1907*)... *net* 2 0

Gas and Petroleum Engines. A Manual for Students and Engineers. By Prof. W. ROBINSON. (FINSBURY TECHNICAL MANUAL.) *Third edition in preparation*

GAS LIGHTING.

Gas Analyst's Manual (incorporating Hartley's "Gas Analyst's Manual" and "Gas Measurement"). By J. ABADY. 102 illustrations, 576 pp. demy 8vo. (*1902*) ... ... *net* 18 0

Gas Works: their Arrangement, Construction, Plant and Machinery. By F. COLYER. 31 folding plates, 134 pp. 8vo. (*1884*) ... ... *net* 8 6

Transactions of the Institution of Gas Engineers. Edited by WALTER T. DUNN, *Secretary.* Published annually. 8vo ... ... *net* 10 6

Lighting by Acetylene. By F. DYE. 75 illus. 200 pp. crown 8vo. (*1902*) ... ... *net* 6 0

Digitized by Google

A Comparison of the English and French Methods of Ascertaining the Illuminating Power of Coal Gas. By A. J. VAN EIJNDHOVEN. Illustrated, crown 8vo. (*1897*) 4 0

Gas Lighting and Gas Fitting. By W. P. GERHARD. Second edition, 190 pp. 18mo, boards. (*New York, 1894*) ... ... *net* 2 0

A Treatise on the Comparative Commercial Values of Gas Coals and Cannels. By D. A. GRAHAM. 3 plates, 100 pp. 8vo. (*1882*) ... 4 6

The Gas Engineer's Laboratory Handbook. By J. HORNBY. Third edition, revised, 70 illus. 330 pp. crown 8vo. (*1911*) ... ... *net* 6 0

Text Book of Gas Manufacture for Students. By J. HORNBY. Sixth edition, 140 illus. 423 pp. 8vo. (*1911*) ... ... *net* 7 6

HISTORICAL AND BIOGRAPHICAL.

Extracts from the Private Letters of the late Sir William Fothergill Cooke, 1836–9, relating to the Invention and Development of the Electric Telegraph; also a Memoir by LATIMER CLARK. Edited by F. H. WEBB. Sec. Inst.E.E. 8vo. (*1895*) 3 0

A Chronology of Inland Navigation in Great Britain. By H. R. DE SALIS. Crown 8vo. (*1897*). 4 6

A History of Electric Telegraphy to the year 1837. By J. J. FAHIE. 35 illus. 542 pp. crown 8vo. (*1889*) 2 0

History and Development of Steam Locomotion on Common Roads. By W. FLETCHER. 109 illus. 288 pp. 8vo 5 0

Life as an Engineer: its Lights, Shades, and Prospects. By J. W. C. HALDANE. 23 plates, 338 pp. crown 8vo. (*1905*) ... ... *net* 5 0

Philipp Reis, Inventor of the Telephone: a Biographical Sketch. By Prof. S. P. THOMPSON. 8vo, cloth. (*1883*) 7 6

The Development of the Mercurial Air Pump. By Prof. S. P. THOMPSON. Illustrated, royal 8vo, sewed. (*1888*) 1 6

Digitized by Google

HOROLOGY.

Watch and Clock Maker's Handbook, Dictionary and Guide. By F. J. BRITTEN. Tenth edition, 450 illus. 492 pp. crown 8vo. (*1902*) *net* 5 0

The Springing and Adjusting of Watches. By F. J. BRITTEN. 75 illus. 152 pp. crown 8vo. (*1898*) ... ... *net* 3 0

Prize Essay on the Balance Spring and its Isochronal Adjustments. By M. IMMISCH. 7 illus. 50 pp. crown 8vo. (*1872*) 2 6

HYDRAULICS AND HYDRAULIC MACHINERY.

(*See also* IRRIGATION *and* WATER SUPPLY.)

The Suction Caused by Ships explained in popular language. By E. S. BELLASIS. 2 plates, 26 pp. 8vo, sewed. (*1912*) ... ... *net* 1 0

Hydraulics with Working Tables. By E. S. BELLASIS. Second edition, 160 illus. xii. + 311 pp. 8vo. (*1911*) ... ... *net* 12 0

Pumps: Historically, Theoretically and Practically Considered. By P. R. BJÖRLING. Second edition, 156 illus. 234 pp. crown 8vo. (*1895*) 7 6

Pump Details. By P. R. BJÖRLING. 278 illus. 211 pp. crown 8vo. (*1892*) 7 6

Pumps and Pump Motors: A Manual for the use of Hydraulic Engineers. By P. R. BJÖRLING. Two vols. 261 plates, 369 pp. royal 4to. (*1895*) *net* 1 10 0

Practical Handbook on Pump Construction. By P. R. BJÖRLING. Second edition, 9 plates, 90 pp. crown 8vo. (*1904*) 5 0

Water or Hydraulic Motors. By P. R. BJÖRLING. 206 illus. 287 pp. crown 8vo. (*1903*) 9 0

Digitized by Google

Hydraulic Machinery, with an Introduction to Hydraulics. By R. G. BLAINE. Second edition with 307 illus. 468 pp. 8vo. (FINSBURY TECHNICAL MANUAL). (*1905*) ... ... *net* 14 0

Practical Hydraulics. By T. Box. Fifteenth edition, 8 plates, 88 pp. crown 8vo. (*1909*) *net* 5 0

The Design of Channels for Irrigation or Drainage. By R. B. BUCKLEY. 56 pp. crown 8vo. (*1911*) ... ... *net* 2 0

Hydraulic, Steam, and Hand Power Lifting and Pressing Machinery. By F. COLYER. Second edition, 88 plates, 211 pp. imperial 8vo. (*1892*) *net* 10 6

Pumps and Pumping Machinery. By F. COLYER.
Vol. I. Second edition, 53 plates, 212 pp. 8vo (*1892*) ... ... *net* 10 6
Vol. II. Second edition, 48 plates, 169 pp. 8vo. (*1900*) ... ... *net* 10 6

Construction of Horizontal and Vertical Water-wheels. By W. CULLEN. Second edition, small 4to. (*1871*) ... ... *net* 5 0

A. B. C. of Hydrodynamics. By LT.-COL. R. DE VILLAMIL, R.E. (retd.). 48 illus. xi + 135 pp. demy 8vo. (*1912*) ... ... *net* 6 0

Donaldson's Poncelet Turbine and Water Pressure Engine and Pump. By W. DONALDSON. 4to. (*1883*) 5 0

Principles of Construction and Efficiency of Waterwheels. By W. DONALDSON. 13 illus. 94 pp. 8vo. (*1876*) 5 0

Practical Hydrostatics and Hydrostatic Formulæ. By E. S. GOULD. 27 illus. 114 pp. 18mo, boards. (*New York, 1903*) ... ... *net* 2 0

Hydraulic and other Tables for purposes of Sewerage and Water Supply. By T. HENNELL. Third edition, 70 pp. crown 8vo. (*1908*) *net* 4 6

Tables for Calculating the Discharge of Water in Pipes for Water and Power Supplies. Indexed at side for ready reference. By A. E. SILK. 63 pp. crown 8vo. (*1899*) 5 0

Simple Hydraulic Formulæ. By T. W. STONE. 9 plates, 98 pp. crown 8vo. (*1881*) 4 0

Digitized by Google

INDUSTRIAL CHEMISTRY AND MANUFACTURES.

Perfumes and their Preparation. By G. W. ASKINSON. Translated from the Third German Edition by I. FUEST. Third edition, 32 illus. 312 pp. 8vo. (*New York, 1907*) ... ... *net* 12 6

Brewing Calculations, Gauging and Tabulation. By C. H. BATER. 340 pp. 64mo, roan, gilt edges. (*1897*) ... ... *net* 1 6

A Pocket Book for Chemists, Chemical Manufacturers, Metallurgists, Dyers, Distillers, etc. By T. BAYLEY. Seventh edition, 550 pp. royal 32mo, roan, gilt edges. (*1905*) ... ... *net* 5 0

Practical Receipts for the Manufacturer, the Mechanic, and for Home use. By Dr. H. R. BERKELEY and W. M. WALKER. 250 pp. demy 8vo. (*1902*) ... ... *net* 7 6

A Treatise on the Manufacture of Soap and Candles, Lubricants and Glycerine. By W. L. CARPENTER and H. LEASK. Second edition, 104 illus. 456 pp. crown 8vo. (*1895*) 12 6

A Text Book of Paper Making. By C. F. CROSS and E. J. BEVAN. Third edition, 97 illus. 411 pp. crown 8vo. (*1907*) ... ... *net* 12 6

C.B.S. Standard Units and Standard Paper Tests. By C. F. CROSS, E. J. BEVAN, C. BEADLE and R. W. SINDALL. 25 pp. crown 4to. (*1903*) *net* 2 6

Pyrometry. By C. R. DARLING. 60 illus. 200 pp. crown 8vo. (*1911*) ... ... *net* 5 0

Soda Fountain Requisites. A Practical Receipt Book for Druggists, Chemists, etc. By G. H. DUBELLE. Third edition, 157 pp. crown 8vo. (*New York, 1905*) ... ... *net* 4 6

Spices and How to Know Them. By W. M. GIBBS. With 47 plates, including 14 in colours, 176 pp. 8vo. (*New York, 1909*) ... ... *net* 15 0

Digitized by Google

The Chemistry of Fire and Fire Prevention. By H. and H. INGLE. 45 illus. 290 pp. crown 8vo. (*1900*) 9 0

Ice-Making Machines. By M. LEDOUX and others. Sixth edition. 190 pp. 18mo, boards. (*New York*, 1906) ... ... *net* 2 0

Brewing with Raw Grain. By T. W. LOVIBOND. 75 pp. crown 8vo. (*1883*) 5 0

The Chemistry, Properties, and Tests of Precious Stones. By J. MASTIN. 114 pp. fcap. 16mo, limp leather, gilt top. (*1911*) *net* 2 6

Sugar, a Handbook for Planters and Refiners. By the late J. A. R. NEWLANDS and B. E. R. NEWLANDS. 236 illus. 876 pp. demy 8vo. (*London, 1909*) ... ... *net* 1 5 0

Principles of Leather Manufacture. By Prof. H. R. PROCTER. 101 illus. 520 pp. medium 8vo. (*1908*) ... ... *net* 18 0

Leather Industries Laboratory Handbook of Analytical and Experimental methods. By H. R. PROCTER. Second edition, 4 plates, 46 illus. 450 pp. demy 8vo. (*1908*) ... ... *net* 18 0

Theoretical and Practical Ammonia Refrigeration. By I. I. REDWOOD. Sixth thousand, 15 illus. 146 pp. square 16mo. (*New York, 1909*) *net* 4 6

Breweries and Maltings. By G. SCAMMELL and F. COLYER. Second edition, 20 plates, 178 pp. 8vo. (*1880*) ... ... *net* 6 0

Factory Glazes for Ceramic Engineers. By H. RUM-BELLOW. Folio. Series A, Leadless Sanitary Glazes. (*1908*) ... ... *net* 2 2 0

Text Book of Physical Chemistry. By C. L. SPEYERS. 224 pp. demy 8vo. (*New York, 1898*) 9 0

Spons' Encyclopædia of the Industrial Arts, Manufactures and Commercial Products. 1500 illus. 2100 pp. super-royal 8vo. (*1882*)
In 2 Vols. cloth ... ... *net* 2 2 0

Pigments, Paints and Painting. By G. TERRY. 49 illus. 392 pp. crown 8vo. (*1893*) 7 6

Digitized by Google

The Absorption Refrigerating Machine. By G. T. VOORHEES. 42 illus. 144 pp. narrow crown 8vo. (*New York, 1911*) ... ... *net* 8 6

Tables for the Quantitative Estimation of the Sugars. By E. WEIN and W. FREW. Crown 8vo. (*1896*) 6 0

The Puering, Bating and Drenching of Skins. By J. T. WOOD. (*In the Press.*)

Workshop Receipts. For the use of Manufacturers, Mechanics and Scientific Amateurs. NEW AND THOROUGHLY REVISED EDITION, crown 8vo. (*1909*) ... ... *each net* 3 0

Vol. I. ACETYLENE LIGHTING *to* DRYING. 223 illus. 532 pp.

Vol. II. DYEING *to* JAPANNING. 259 illus. 540 pp.

Vol. III. JOINTING PIPES *to* PUMPS. 256 illus. 528 pp.

Vol. IV. RAINWATER SEPARATORS *to* WIRE ROPE, SPLICING. 321 illus. 540 pp.

Practical Handbook on the Distillation of Alcohol from Farm Products. By F. B. WRIGHT. Second edition, 60 illus. 271 pp. crown 8vo. (*New York, 1907*) ... ... *net* 4 6

The Manufacture of Chocolate and other Cacao Preparations. By P. ZIPPERER. Second edition, 87 illus. 280 pp. royal 8vo. (*1902*) ... *net* 16 0

INTEREST TABLES.

The Wide Range Dividend and Interest Calculator, showing at a glance the Percentage on any sum from One Pound to Ten Thousand Pounds, at any Interest, from 1 % to 12½ %, proceeding by ¼ %. By A. STEVENS. 100 pp. super royal 8vo, quarter-bound. (*1911*) ... *net* 12 6

The Wide Range Income Tax Calculator, showing at a glance the Tax on any sum from One Shilling to Thousand Pounds, at the Rate of 9*d.*, 1/– and 1/2 in the Pound. By A. STEVENS. On folding card, imperial 8vo *net* 1 0

Digitized by Google

IRRIGATION.

Punjab Rivers and Works. By E. S. BELLASIS. 47 illus. 65 pp. folio, cloth. (*1911*) ... *net* 8 0

Irrigation Pocket Book. By R. B. BUCKLEY. 419 pp. crown 8vo, leather cloth with rounded corners. (*1911*) ... ... *net* 12 6

The Design of Channels for Irrigation and Drainage. By R. B. BUCKLEY. 22 diagrams, 56 pp. crown 8vo. (*1911*) ... ... *net* 2 0

The Irrigation Works of India. By R. B. BUCKLEY. Second edition, with coloured maps and plans. 336 pp. 4to, cloth. (*1905*) ... *net* 2 2 0

Irrigated India. By Hon. ALFRED DEAKIN. With Map, 322 pp. 8vo. (*1893*) 8 6

Indian Storage Reservoirs, with Earthen Dams. By W. L. STRANGE. 14 plates and 53 illus. 379 pp. demy 8vo. (*1904*) ... ... *net* 1 1 0

Irrigation Farming. By L. M. WILCOX. Revised edition, 113 illus. 494 pp. crown 8vo. (*New York*) ... ... *net* 8 6

Egyptian Irrigation. By Sir W. WILLCOCKS. *Third edition in preparation.*

A few copies of the First Edition (1889) are still to be had. Price 15s. net.

The Nile Reservoir Dam at Assuan, and After. By Sir W. WILLCOCKS. Second edition, 13 plates, super-royal 8vo. (*1903*) ... ... *net* 6 0

The Assuân Reservoir and Lake Moeris. By Sir W. WILLCOCKS. With text in English, French and Arabic. 5 plates, 116 pp. super-royal 8vo. (*1904*) ... ... *net* 5 0

The Nile in 1904. By Sir W. WILLCOCKS. 30 plates, 200 pp. super-royal 8vo. (*1904*) *net* 9 0

Digitized by Google

LOGARITHM TABLES.

Aldum's Pocket Folding Mathematical Tables. Four-figure logarithms, and Anti-logarithms, Natural Sines, Tangents, Cotangents, Cosines, Chords and Radians for all angles from 1 to 90 degrees. And Decimaliser Table for Weights and Money. On folding card. *Net 4d.* 20 copies, *net 6s.*

Tables of Seven-figure Logarithms of the Natural Numbers from 1 to 108,000. By C. BABBAGE. Stereotype edition, 8vo 7 6

Four-Place Tables of Logarithms and Trigonometric Functions. By E. V. HUNTINGTON. Ninth thousand, 34 pp. square 8vo, limp buckram, with cut lateral index. (*New York, 1911.*) *net* 3 0

Short Logarithmic and other Tables. By W. C. UNWIN. Fourth edition, small 4to 3 0

Logarithmic Land Measurement. By J. WALLACE. 32 pp. royal 8vo. (*1910*) ... ... *net* 5 0

A. B. C. Five-figure Logarithms with Tables, for Chemists. By C. J. WOODWARD. Crown 8vo ... ... *net* 2 6

A. B. C. Five-figure Logarithms for general use, with lateral index for ready reference. By C. J. WOODWARD. Second edition, with cut lateral Index, 116 pp. 12mo, limp leather ... *net* 3 0

MARINE ENGINEERING AND NAVAL ARCHITECTURE.

Marine Propellers. By S. W. BARNABY. Fifth edition, 5 plates, 56 illus. 185 pp. demy 8vo. (*1908*) ... ... *net* 10 6

Marine Engineer's Record Book: Engines. By B. C. BARTLEY. 8vo, roan ... ... *net* 5 0

The Suction Caused by Ships and the Olympic-Hawke Collision. By E. S. BELLASIS. 1 chart and 5 illus. in text, 26 pp. 8vo, sewed. (*1912*) *net* 1 0

Digitized by Google

Yachting Hints, Tables and Memoranda. By A. C. FRANKLIN. Waistcoat pocket size, 103 pp. 64mo, roan, gilt edges ... ... *net* 1 (

Steamship Coefficients, Speeds and Powers. By C. F. A. FYFE. 31 plates, 280 pp. fcap. 8vo, leather. (*1907*) ... ... *net* 10 (

Steamships and Their Machinery, from first to last. By J. W. C. HALDANE. 120 illus. 532 pp. 8vo. (*1893*) ... ... 15 (

Tables for Constructing Ships' Lines. By A. HOGG. Third edition, 3 plates, 20 pp. 8vo, sewed (*1911*) ... ... *net* 3 (

Submarine Boats. By G. W. HOVGAARD. 2 plates, 98 pp. crown 8vo. (*1887*) ... ... 5 (

Tabulated Weights of Angle, Tee, Bulb, Round, Square, and Flat Iron and Steel for the use of Naval Architects, Ship-builders, etc. By C. H. JORDAN. Sixth edition, 640 pp. royal 32mo, French morocco, gilt edges. (*1909*) ... *net* 7 (

Particulars of Dry Docks, Wet Docks, Wharves, etc. on the River Thames. Compiled by C. H. JORDAN. Second edition, 7 coloured charts, 103 pp. oblong 8vo. (*1904*) ... ... *net* 2 (

Marine Transport of Petroleum. By H. LITTLE. 66 illus. 263 pp. crown 8vo. (*1890*) ... ... 10 (

Questions and Answers for Marine Engineers, with a Practical Treatise on Breakdowns at Sea. By T. LUCAS. 12 folding plates, 515 pp. gilt edges, crown 8vo. (*New York, 1902*) ... *net* 8 (

Reed's Examination Papers for Extra First Class Engineers. Fourth edition, 14 plates and 188 illus. 550 pp. 8vo. (*1902*) ... ... *net* 18 (

Reed's Engineers' Handbook to the Board of Trade Examinations for certificates of Competency as First and Second Class Engineers. Nineteenth edition, 37 plates, 358 illus. 696 pp. 8vo ... ... *net* 14 (

Reed's Marine Boilers. Second edition, crown 8vo *net* 4 (

Reed's Useful Hints to Sea-going Engineers. Fourth edition, 8 plates, 50 illus. 312 pp. crown 8vo. (*1903*) ... ... *net* 3 (

Digitized by Google

MATERIALS.

Practical Treatise on the Strength of Materials. By T. Box. Fourth edition, 27 plates, 536 pp. 8vo. (*1902*) ... ... *net* 12 6

Treatise on the Origin, Progress, Prevention and Cure of Dry Rot in Timber. By T. A. BRITTON. 10 plates, 519 pp. crown 8vo. (*1875*) 7 6

Solid Bitumens. By S. F. PECKHAM. 23 illus. 324 pp. 8vo. (*New York, 1909*) ... ... *net* 1 1 0

Lubricants, Oils and Greases. By I. I. REDWOOD. 3 plates, 8vo. (*1898*) ... ... *net* 6 6

Practical Treatise on Mineral Oils and their By-Products. By I. I. REDWOOD. 67 illus. 336 pp. demy 8vo. (*1897*) 15 0

Silico-Calcareous Sandstones, or Building Stones from Quartz, Sand and Lime. By E. STOFFLER. 5 plates, 8vo, sewed. (*1901*) ... ... *net* 4 0

Proceedings of the Fifth Congress, International Association for Testing Materials. English edition. 189 illus. 549 pp. demy 8vo. (*1910*).

Paper ... ... *net* 15 0
Cloth ... . *net* 18 0

MATHEMATICS.

Imaginary Quantities. By M. ARGAND. Translated by PROF. HARDY. 18mo, boards. (*New York*) *net* 2 0

Text Book of Practical Solid Geometry. By E. H. DE V. ATKINSON. Revised by MAJOR B. R. WARD, R.E. Second edition, 17 plates, 8vo. (*1901*) 7 6

Digitized by Google

Quick and Easy Methods of Calculating, and the Theory and Use of the Slide Rule. By R. G. BLAINE. Third edition, 6 illus. 152 pp. 16mo, leather cloth. (*1907*) 2 6

Symbolic Algebra, or the Algebra of Algebraic Numbers. By W. CAIN. 18mo, boards. (*New York*) ... ... *net* 2 0

Nautical Astronomy. By J. H. COLVIN. 127 pp. crown, 8vo. (*1901*) ... ... *net* 2 6

Chemical Problems. By J. C. FOYE. Fourth edition, 141 pp. 18mo, boards. (*New York, 1898*)... *net* 2 0

Primer of the Calculus. By E. S. GOULD. Second edition, 24 illus. 122 pp. 18mo, boards. (*New York, 1899*) ... ... *net* 2 0

Elementary Treatise on the Calculus for Engineering Students. By J. GRAHAM. Third edition, 276 pp. crown 8vo. (FINSBURY TECHNICAL MANUAL.) (*1905*) 7 6

Manual of the Slide Rule. By F. A. HALSEY. Second edition, 31 illus. 84 pp. 18mo, boards. (*New York, 1901*) ... ... *net* 2 0

Reform in Chemical and Physical Calculations. By C. J. T. HANSSEN. 4to. (*1897*) ... *net* 6 6

Algebra Self-Taught. By P. HIGGS. Third edition, 104 pp.crown 8vo. (*1903*) 2 6

A Text-book on Graphic Statics. By C. W. MALCOLM. 155 illus. 316 pp. 8vo. (*New York, 1909*) ... ... *net* 12 6

Galvanic Circuit investigated Mathematically. By G. S. OHM. Translated by WILLIAM FRANCIS. 269 pp. 18mo, boards. (*New York, 1891*) ... *net* 2 0

Elementary Practical Mathematics. By M. T. ORMSBY. Second edition, revised. 410 pp. medium 8vo. (*1911*) ... ... *net* 5 0

Elements of Graphic Statics. By K. VON OTT. Translated by G. S. CLARKE. 93 illus. 128 pp. crown 8vo. (*1901*) 5 0

Figure of the Earth. By F. C. ROBERTS. 18mo, boards. (*New York*) ... ... *net* 2 0

Digitized by Google

Arithmetic of Electricity. By T. O'C. SLOANE. Thirteenth edition, crown 8vo. (*New York, 1901*) ... ... *net* 4 6

Graphic Method for Solving certain Questions in Arithmetic or Algebra. By G. L. VOSE. Second edition with 28 illus. 62 pp. 18mo, boards. (*New York, 1902*) ... ... *net* 2 0

Problems in Electricity. A Graduated Collection comprising all branches of Electrical Science. By R. WEBER. Translated from the French by E. A. O'KEEFE. 34 illus. 366 pp. crown 8vo. (*1902*) ... ... *net* 7 6

MECHANICAL ENGINEERING.

STEAM ENGINES AND BOILERS, ETC.

Engineers' Sketch Book of Mechanical Movements. By T. W. BARBER. Fifth edition, 3000 illus. 355 pp. 8vo. (*1906*) ... ... *net* 10 6

The Repair and Maintenance of Machinery. By T. W. BARBER. 417 illus. 476 pp. 8vo. (*1895*) ... 10 6

Practical Treatise on Mill Gearing. By T. BOX. Fifth edition, 11 plates, 128 pp. crown 8vo. (*1892*) 7 6

The Mechanical Engineers' Price Book, 1912. Edited by G. BROOKS. With Diary showing a week at an opening. 176 pp. pocket size (6½ in. by 3¾ in. by ½ in. thick), leather cloth, with rounded corners. (*1912*) ... ... *net* 4 0

Safety Valves. By R. H. BUELL. Third edition, 20 illus. 100 pp. 18mo, boards. (*New York, 1898*) *net* 2 0

Digitized by Google

Machine Design. By Prof. W. L. CATHCART. Part I. FASTENINGS. 123 illus. 291 pp. demy 8vo. (*New York, 1903*) ... *net* 12 6

Chimney Design and Theory. By W. W. CHRISTIE. Second edition, 54 illus. 192 pp. crown 8vo. (*New York, 1902*) ... ... *net* 12 6

Furnace Draft: its Production by Mechanical Methods. By W. W. CHRISTIE. 5 illus. 80 pp. 18mo, boards. (*New York, 1906*) ... ... *net* 2 0

Working and Management of Steam Boilers and Engines. By F. COLYER. Second edition, 108 pp. crown 8vo. (*1902*) 3 6

The Stokers' Catechism. By W. J. CONNOR. 63 pp. limp cloth. (*1906*) ... ... *net* 1 0

Treatise on the use of Belting for the Transmission of Power. By J. H. COOPER. Fifth edition, 94 illus. 399 pp. demy 8vo. (*New York, 1901*) ... *net* 12 6

The Steam Engine considered as a Thermodynamic Machine. By J. H. COTTERILL. Third edition, 39 diagrams, 444 pp. 8vo. (*1896*) ... 15 0

Fireman's Guide, a Handbook on the Care of Boilers. By K. P. DAHLSTROM. Eleventh edition, fcap. 8vo, limp. (S. & C. SERIES, No. 16.) (*New York, 1906*) ... ... *net* 1 6

Heat for Engineers. By C. R. DARLING. Second edition, 110 illus. 430 pp. 8vo. (FINSBURY TECHNICAL MANUAL.) (*1912*) ... ... *net* 12 6

Diseases of a Gasolene Automobile, and How to Cure Them. By A. L. DYKE. 127 illus. 201 pp. crown 8vo. (*New York, 1903*) ... ... *net* 6 6

Belt Driving. By G. HALLIDAY. 3 folding plates, 100 pp. 8vo. (*1894*) 3 6

Worm and Spiral Gearing. By F. A. HALSEY. 13 plates, 85 pp. 18mo, boards. (*New York, 1903*) *net* 2 0

Commercial Efficiency of Steam Boilers. By A. HANSSEN. Large 8vo, sewed. (*1898*) ... 0 6

Corliss Engine. By J. T. HENTHORN. Third edition, 23 illus. 95 pp. square 16mo. (S. & C. SERIES, No. 23.) (*New York, 1910*) ... *net* 1 6

Digitized by Google

Liquid Fuel for Mechanical and Industrial Purposes. By E. A. BRAYLEY HODGETTS. 106 illus. 129 pp. 8vo. (*1890*) 5 0

Elementary Text-Book on Steam Engines and Boilers. By J. H. KINEALY. Fourth edition, 106 illus. 259 pp. 8vo. (*New York, 1903*) ... *net* 8 6

Centrifugal Fans. By J. H. KINEALY. 33 illus. 206 pp. fcap. 8vo, leather. (*New York, 1905*) *net* 12 6

Mechanical Draft. By J. H. KINEALY. 27 original tables and 13 plates, 142 pp. crown 8vo. (*New York, 1906*) ... ... *net* 8 6

The A. B. C. of the Steam Engine, with a description of the Automatic Governor. By J. P. LISK. 6 plates, 12mo. (S. & C. SERIES, No. 17.) (*New York, 1910*) ... ... *net* 1 6

Valve Setting Record Book. By P. A. LOW. 8vo, boards... ... ... 1 6

The Lay-out of Corliss Valve Gears. By S. A. Moss. Second edition, 3 plates, 108 pp. 18mo, boards. (*New York, 1906*) ... ... *net* 2 0

Steam Boilers, their Management and Working. By J. PEATTIE. Fifth edition, 35 illus. 230 pp. crown 8vo. (*1906*) ... ... *net* 4 6

Treatise on the Richards Steam Engine Indicator. By C. T. PORTER. Sixth edition, 3 plates and 73 diagrams, 285 pp. 8vo. (*1902*) 9 0

Practical Treatise on the Steam Engine. By A. RIGG. Second edition, 103 plates, 378 pp. demy 4to. (*1894*) 1 5 0

Power and its Transmission. A Practical Handbook for the Factory and Works Manager. By T. A. SMITH. 76 pp. fcap. 8vo. (*1910*) ... *net* 2 0

Drawings for Medium Sized Repetition Work. By R. D. SPINNEY. With 47 illus. 130 pp. 8vo. (*1909*) ... ... *net* 3 6

Slide Valve Simply Explained. By W. J. TENNANT. Revised by J. H. KINEALY. 41 illus. 83 pp. crown 8vo. (*New York, 1899*) ... *net* 4 6

Shaft Governors. By W. TRINKS and C. HOOSUM. 27 illus. 97 pp. 18mo, boards. (*New York, 1905*) *net* 2 0

Digitized by Google

Treatise on the Design and Construction of Mill Buildings. By H. G. TYRRELL. 652 illus. 490 pp, 8vo. (*New York, 1911*) ... ... *net* 17 0

Slide and Piston Valve Geared Steam Engines. By W. H. UHLAND. 47 plates and 314 illus. 155 pp. Two vols. folio, half morocco. (*1882*) 1 16 0

How to run Engines and Boilers. By E. P. WATSON. Fifth edition, 31 illus. 160 pp. crown 8vo. (*New York, 1904*) 3 6

Position Diagram of Cylinder with Meyer Cut-off. By W. H. WEIGHTMAN. On card. (*New York*) ... ... *net* 1 0

Practical Method of Designing Slide Valve Gearing. By E. J. WELCH. 69 diagrams, 283 pp. Crown 8vo. (*1890*) 6 0

Elements of Mechanics. By T. W. WRIGHT. Eighth edition, illustrated, 382 pp. 8vo. (*New York, 1909*) ... ... *net* 10 6

METALLURGY.

IRON AND STEEL MANUFACTURE.

Life of Railway Axles. By T. ANDREWS. 8vo, sewed. (*1895*) 1 0

Microscopic Internal Flaws in Steel Rails and Propeller Shafts. By T. ANDREWS. 8vo, sewed. (*1896*) 1 0

Microscopic Internal Flaws, Inducing Fracture in Steel. By T. ANDREWS. 8vo, sewed. (*1896*) 2 0

Relations between the Effects of Stresses slowly applied and of Stresses suddenly applied in the case of Iron and Steel: Comparative Tests with Notched and Plain Bars. By P. BREUIL. 23 plates and 60 illus. 151 pp. 8vo. (*1904*) *net* 8 0

Practical Alloying. A compendium of Alloys and Processes for Brassfounders, Metal Workers, and Engineers. By JOHN F. BUCHANAN. With 41 illus. 205 pp. 8vo, cloth. (*New York, 1911*) *net* 10 6

Digitized by Google

Brassfounders' Alloys. By J. F. BUCHANAN. Illustrated, 129 pp. crown 8vo. (*1905*) ... *net* 4 6

The Moulder's Dictionary (Foundry Nomenclature). A concise guide to Foundry Practice By JOHN F. BUCHANAN. Illustrated, 225 pp. crown 8vo. (*1903*) ... ... *net* 3 0

American Standard Specifications for Steel. By A. L. COLBY. Second edition, revised, 103 pp. crown 8vo. (*New York, 1902*) ... ... *net* 5 0

Pyrometry. By C. R. DARLING. 60 illus. 200 pp. crown 8vo. (*1911*) ... ... *net* 5 0

Galvanised Iron: its Manufacture and Uses. By J. DAVIES. 139 pp. 8vo. (*1899*) ... ... *net* 5 0

Management of Steel. By G. EDE. Seventh edition, 216 pp. crown 8vo. (*1903*) 5 0

Galvanising and Tinning, with a special Chapter on Tinning Grey Iron Castings. By W. T. FLANDERS. 8vo. (*New York*) ... ... *net* 8 6

The Frodair Handbook for Ironfounders. 160 pp. 12mo. (*1910*) ... ... *net* 2 0

Cupola Furnace. A practical treatise on the Construction and Management of Foundry Cupolas. By E. KIRK. Third edition, 106 illus. 484 pp. demy 8vo. (*New York, 1910*) ... *net* 15 0

Practical Notes on Pipe Founding. By J. W. MACFARLANE. 15 plates, 148 pp. 8vo 12 6

Atlas of Designs concerning Blast Furnace Practice. By M. A. PAVLOFF. 127 plates, 14 in. by 10½ in. oblong, sewed. (*1902*) ... ... *net* 1 1 0

Album of Drawings relating to the Manufacture of Open Hearth Steel. By M. A. PAVLOFF.

Part I. Open Hearth Furnaces. 52 plates, 14 in. by 10½ in. oblong folio in portfolio. (*1904*) ... ... *net* 12 0

Digitized by Google

Metallography Applied to Siderurgic Products. By H. SAVOIA. Translated by R. G. CORBET. With 94 illus. 180 pp. crown 8vo. (*1910*) *net* 4 6

Modern Foundry Practice. Including revised subject matter and tables from SPRETSON'S "Casting and Founding." By J. SHARP. Second edition New impression, 272 illus. 759 pp. 8vo. (*1911*) ... ... *net* 1 1 0

Roll Turning for Sections in Steel and Iron. By A. SPENCER. Second edition, 78 plates, 4to. (*1894*) 1 10 0

METRIC TABLES.

French Measure and English Equivalents. By J. BROOK. Second edition, 80 pp. fcap. 32mo, roan. (*1906*) ... ... *net* 1 0

A Dictionary of Metric and other useful Measures. By L. CLARK. 113 pp. 8vo. (*1891*) ... 6 0

English Weights, with their Equivalents in kilogrammes. By F. W. A. LOGAN. 96 pp. fcap. 32mo, roan. (*1906*) ... ... *net* 1 0

Metric Weights with English Equivalents. By H. P. MCCARTNEY. 84 pp. fcap. 32mo. (*1907*) *net* 1 0

Metric Tables. By Sir G. L. MOLESWORTH. Fourth edition, 95 pp. royal 32mo. (*1909*) ... *net* 2 0

Tables for Setting out Curves from 200 metres to 4000 metres by tangential angles. By H. WILLIAMSON. 4 illus. 60 pp. 18mo. (*1908*) *net* 2 0

MINERALOGY AND MINING.

Rock Blasting. By G. G. ANDRE. 12 plates and 56 illus. in text, 202 pp. 8vo. (*1878*) 5 0

Winding Plants for Great Depths. By H. C. BEHR. In two parts. 8vo, sewed. (*1902*) *net* 2 2 0

Digitized by Google

Practical Treatise on Hydraulic Mining in California. By A. J. BOWIE, Jun. Tenth edition, 73 illus. 313 pp. royal 8vo. (*New York, 1905*) ... ... *net* 1 1 0

Tables for the Determination of Common Rocks. By O. BOWLES. 64 pp. 18mo, boards. (VAN NOSTRAND SERIES, No. 125.) (*New York, 1910*) ... ... *net* 2 0

Manual of Assaying Gold, Silver, Copper and Lead Ores. By W. L. BROWN. Twelfth edition, 132 illus. 589 pp. crown 8vo. (*New York, 1907*) *net* 10 6

Fire Assaying. By E. W. BUSKETT. 69 illus. 105 pp. crown 8vo. (*New York, 1907*) ... *net* 4 6

Tin: Describing the Chief Methods of Mining, Dressing, etc. By A. G. CHARLETON. 15 plates, 83 pp. crown 8vo. (*1884*) 12 6

Gold Mining and Milling in Western Australia, with Notes upon Telluride Treatment, Costs and Mining Practice in other Fields. By A. G. CHARLETON. 82 illus. and numerous plans and tables, 648 pp. super-royal 8vo. (*1903*) ... *net* 1 5 0

Miners' Geology and Prospectors' Guide. By G. A. CORDER. 29 plates, 224 pp. crown 8vo. (*1907*) ... ... *net* 5 0

Blasting of Rock in Mines, Quarries, Tunnels, etc. By A. W. and Z. W. DAW. Second edition, 90 illus. 316 pp. demy 8vo. (*1909*) ... *net* 15 0

Handbook of Mineralogy; determination and description of Minerals found in the United States. By J. C. FOYE. 18mo, boards. (*New York, 1886*) *net* 2 0

Our Coal Resources at the End of the Nineteenth Century. By Prof. E. HULL. 157 pp. demy 8vo. (*1897*) 6 0

Hydraulic Gold Miners' Manual. By T. S. G. KIRKPATRICK. Second edition, 12 illus. 46 pp. crown 8vo. (*1897*) 4 0

Economic Mining. By C. G. W. LOCK. 175 illus. 680 pp. 8vo. (*1895*) ... ... *net* 10 6

Digitized by Google

Gold Milling: Principles and Practice. By C. G. W. LOCK. 200 illus. 850 pp. demy 8vo. (*1901*) *net* 1 1 0

Mining and Ore-Dressing Machinery. By C. G. W. LOCK. 639 illus. 466 pp. super-royal 4to. (*1890*) 1 5 0

Miners' Pocket Book. By C. G. W. LOCK. Fifth edition, 233 illus. 624 pp. fcap. 8vo, roan, gilt edges. (*1908*) ... ... *net* 10 6

Chemistry, Properties and Tests of Precious Stones. By J. MASTIN. 114 pp. fcap. 16mo, limp leather, gilt top. (*1911*) ... ... *net* 2 6

Tests for Ores, Minerals and Metals of Commercial Value. By R. L. MCMECHEN. 152 pp. 12mo. (*New York, 1907*) ... ... *net* 5 6

Practical Handbook for the Working Miner and Prospector, and the Mining Investor. By J. A. MILLER. 34 illus. 234 pp. crown 8vo. (*1897*) 7 6

Theory and Practice of Centrifugal Ventilating Machines. By D. MURGUE. 7 illus. 81 pp. 8vo. (*1883*) 5 0

Examples of Coal Mining Plant. By J. POVEY-HARPER. Second edition, 40 plates, 26 in. by 20 in. (*1895*) ... ... *net* 4 4 0

Examples of Coal Mining Plant, Second Series. By J. POVEY-HARPER. 10 plates, 26 in. by 20 in. (*1902*) ... ... *net* 1 12 6

MODELS AND MODEL MAKING.

How to Build a Model Yacht. By H. FISHER. Numerous illustrations, 50 pp. 4to. (*New York, 1902*) ... ... *net* 4 6

Model Engines and Small Boats. By N. M. HOPKINS. 50 illus. crown 8vo. (*New York, 1898*) *net* 5 9

Digitized by Google

The Gyroscope, an Experimental Study. By V. E. JOHNSON. 34 illus. 40 pp. crown 8vo, limp. (S. & C. SERIES, No. 22.) (*1911*) ... ... *net* 1 6

The Model Vaudeville Theatre. By N. H. SCHNEIDER. 34 illus. 90 pp. crown 8vo, limp. (S. & C. SERIES, No. 15.) *New York, 1910*) ... 1 6

Electric Toy-Making. By T. O. SLOANE. Fifteenth edition, 70 illus. 183 pp. crown 8vo. (*New York, 1903*) ... ... *net* 4 6

Model Steam Engine Design. By R. M. DE VIGNIER. 34 illus. 94 pp. crown 8vo, limp. (S. & C. SERIES, No. 9.) (*New York, 1907*) ... *net* 1 6

Small Engines and Boilers. By E. P. WATSON. 30 full page working drawings, crown 8vo. (*New York, 1899*) ... ... *net* 5 6

ORGANISATION.

ACCOUNTS, CONTRACTS AND MANAGEMENT.

Organisation of Gold Mining Business, with Specimens of the Departmental Report Books and the Account Books. By NICOL BROWN. Second edition, 220 pp. fcap. folio. (*1903*) *net* 1 5 0

Cost Keeping and Management Engineering. A Treatise for those engaged in Engineering Construction. By H. P. GILLETTE and R. T. DANA. With 184 illus. 346 pp. 8vo. (*New York, 1909*) *net* 15 0

Manual of Engineering Specifications and Contracts. By L. M. HAUPT. Eighth edition, 338 pp. 8vo. (*New York, 1900*) ... ... *net* 12 6

Handbook on Railway Stores Management. By W. O. KEMPTHORNE. 268 pp. demy 8vo. (*1907*) ... ... *net* 10 6

Depreciation of Factories, Municipal, and Industrial Undertakings, and their Valuation. By E. MATHESON. Fourth edition, 230 pp. 8vo, cloth. (*1910*) ... ... *net* 10 6

Digitized by Google

Aid Book to Engineering Enterprise. By E. MATHESON. Third edition, 916 pp. 8vo, buckram. (*1898*) 1 4 0

Office Management. A handbook for Architects and Civil Engineers. By W. KAYE PARRY. New impression, 187 pp. medium 8vo. (*1908*) *net* 5 0

Commercial Organisation of Engineering Factories. By H. SPENCER. 92 illus. 221 pp. 8vo. (*1907*) ... ... *net* 10 6

PHYSICS.

COLOUR, HEAT AND EXPERIMENTAL SCIENCE.

The Entropy Diagram and its Applications. By M. J. BOULVIN. 38 illus. 82 pp. demy 8vo. (*1898*) 5 0

Physical Problems and their Solution. By A. BOURGOUGNON. 224 pp. 18mo, boards. (*New York, 1897*) ... ... *net* 2 0

Heat for Engineers. By C. R. DARLING. Second edition, 110 illus. 430 pp. 8vo. (FINSBURY TECHNICAL MANUAL.) (*1912*) ... ... *net* 12 6

The Colourist. A method of determining colour harmony. By J. A. H. HATT. 2 coloured plates, 80 pp. 8vo. (*New York, 1908*) ... ... *net* 6 6

Engineering Thermodynamics. By C. F. HIRSCHFELD. 22 illus. 157 pp. 18mo, boards. (*New York, 1907*) ... ... *net* 2 0

Experimental Science: Elementary, Practical and Experimental Physics. By G. M. HOPKINS. Twenty-third edition, 920 illus. 1100 pp. large 8vo. (*New York, 1902*) ... ... *net* 1 1 0

Reform in Chemical and Physical Calculations. By C. J. T. HANSSEN. Demy 4to. (*1897*) *net* 6 6

Introduction to the Study of Colour Phenomena. By J. W. LOVIBOND. 10 hand coloured plates, 48 pp. 8vo. (*1905*) ... ... *net* 5 0

Digitized by Google

Practical Laws and Data on the Condensation of Steam in Bare Pipes; to which is added a Translation of PECLET'S Theory and Experiments on the Transmission of Heat through Insulating Materials. By C. P. PAULDING. 184 illus. 102 pp. demy 8vo. (*New York, 1904*) *net* 8 6

The Energy Chart. Practical application to reciprocating steam-engines. By Captain H. R. SANKEY. 157 illus. 170 pp. 8vo. (*1907*) ... *net* 7 6

PRICE BOOKS.

The Mechanical Engineers' Price Book, 1912. With Diary. By G. BROOKS. 176 pp. pocket size (6½ in. by 3¾ in. by ½ in. thick), leather cloth, with rounded corners. (*1912*) ... ... *net* 4 0

Approximate Estimates. By T. E. COLEMAN. Third edition, 481 pp. oblong 32mo, leather. (*1907*) ... ... *net* 5 0

The Civil Engineers' Cost Book. By MAJOR T. E. COLEMAN. xii. + 289 pp. pocket size (6½ in. by 3¾ in.), leather cloth. (*1912*) ... ... *net* 5 0

Railway Stores Price Book. By W. O. KEMPTHORNE. 500 pp. demy 8vo. (*1909*) ... *net* 10 6

Handbook of Cost Data for Contractors and Engineers. By H. P. GILLETTE. 1854 pp. crown 8vo, leather, gilt edges. (*New York, 1910*) *net* 1 1 0

Telephone Construction, Methods and Cost. By C. MAYER. With Appendices on the cost of Materials and Labour. By J. E. SLIPPY. 103 illus. 284 pp. crown 8vo. (*New York*) ... *net* 12 6

Concrete Construction, Methods and Cost. By H. P. GILLETTE and C. S. HILL. 310 illus. 690 pp. 8vo. (*New York, 1908*) ... ... *net* 1 1 0

Spons' Architects' and Builders' Pocket Price-Book and Diary, 1912. Edited by CLYDE YOUNG. Revised by STANFORD M. BROOKS. Illustrated, 239 pp. green leather cloth. With Diary showing a week at an opening. (Size 6½ in. by 3¾ in. by ½ in. thick). Issued annually ... *net* 2 6

Digitized by Google

RAILWAY ENGINEERING.

Practical Hints to Young Engineers Employed on Indian Railways. By A. W. C. ADDIS. With 14 illus. 154 pp. 12mo. (*1910*) ... *net* 3 6

Railroad Curves and Earthwork. By C. F. ALLEN. Third edition, 4 plates, 198 pp. 12mo, leather, gilt edges. (*New York, 1903*) ... *net* 8 6

Field and Office Tables, specially applicable to Railroads. By C. F. ALLEN. 293 pp. 16mo, leather. (*New York, 1903*) ... ... *net* 8 6

The two above combined in one vol. limp leather ... *net* 12 6

Up-to-date Air Brake Catechism. By R. H. BLACKALL. Twenty-third edit. 5 coloured plates, 96 illus. 305 pp. crown 8vo. (*New York, 1908*) *net* 8 6

Simple and Automatic Vacuum Brakes. By C. BRIGGS, G.N.R. 11 plates, 8vo. (*1892*) ... 4 0

Notes on Permanent-way Material, Plate-laying, and Points and Crossings. By W. H. COLE. Sixth edition, revised, with 44 illus. in 39 plates, 203 pp. crown 8vo. (*1912*) ... ... *net* 7 6

Statistical Tables of the Working of Railways in various countries up to the year 1904. By J. D. DIACOMIDIS. Second edition, 84 pp. small folio, sewed. (*1906*) ... ... *net* 16 0

Locomotive Breakdowns, Emergencies and their Remedies. By GEO. L. FOWLER, M.E., and W. W. WOOD. Fifth edition, 92 illus. 266 pp. 12mo. (*New York, 1911*) ... ... *net* 4 6

Permanent-Way Diagrams. By F. H. FRERE. Mounted on linen in cloth covers. (*1908*) *net* 3 0

Formulæ for Railway Crossings and Switches. By J. GLOVER. 9 illus. 28 pp. royal 32mo. (*1896*) 2 6

Data relating to Railway Curves and Super-elevations, shown graphically. By J. H. HAISTE. On folding card for pocket use ... ... *net* 0 6

Digitized by Google

Setting out of Tube Railways. By G. M. HALDEN. 9 plates, 46 illus. 68 pp. crown 4to. (*1907*) *net* 10 6

Railway Engineering, Mechanical and Electrical. By J. W. C. HALDANE. 141 illus. 563 pp. 8vo. (*1897*) 15 0

Tables for setting-out Railway Curves. By C. P. HOGG. A series of cards in neat cloth case ... 4 6

The Construction of the Modern Locomotive. By G. HUGHES. 300 illus. 261 pp. 8vo. (*1894*) 9 0

Practical Hints for Light Railways at Home and Abroad. By F. R. JOHNSON. 6 plates, 31 pp. crown 8vo. (*1896*) 2 6

Handbook on Railway Stores Management. By W. O. KEMPTHORNE. 268 pp. demy 8vo. (*1907*) *net* 10 6

Railway Stores Price Book. By W. O. KEMPTHORNE. 487 pp. demy 8vo. (*1909*) ... *net* 10 6

Tables for setting out Curves for Railways, Roads, Canals, etc. By A. KENNEDY and R. W. HACKWOOD. 32mo ... ... *net* 2 0

Railroad Location Surveys and Estimates. By F. LAVIS. 68 illus. 270 pp. 8vo. (*New York, 1906*) *net* 12 6

Tables for Computing the Contents of Earthwork in the Cuttings and Embankments of Railways. By W. MACGREGOR. Royal 8vo ... 6 0

Bridge and Tunnel Centres. By J. B. MCMASTERS. Illustrated, 106 pp. 18mo, boards. (*New York, 1893*) ... ... *net* 2 0

Pioneering. By F. SHELFORD. Illustrated, 88 pp. crown 8vo. (*1909*) ... ... *net* 3 0

Handbook on Railway Surveying for Students and Junior Engineers. By B. STEWART. 55 illus. 98 pp. crown 8vo. (*1909*) ... ... *net* 2 6

Spiral Tables. By J. G. SULLIVAN. 47 pp. 12mo, leather. (*New York, 1908*) ... ... *net* 6 6

Digitized by Google

Modern British Locomotives. By A. T. TAYLOR. 100 diagrams of principal dimensions, 118 pp. oblong 8vo. (*1907*) ... ... *net*

Locomotive Slide Valve Setting. By C. E. TULLY. Illustrated, 18mo ... ... *net*

The Walschaert Locomotive Valve Gear. By W. W. WOOD. 4 plates and set of movable cardboard working models of the valves, 193 pp. crown 8vo. (*New York, 1907*) ... ... *net*

The Westinghouse E.T. Air-Brake Instruction Pocket Book. By W. W. WOOD. 48 illus. including many coloured plates, 242 pp. crown 8vo. (*New York, 1909*) ... ... *net*

SANITATION, PUBLIC HEALTH AND MUNICIPAL ENGINEERING.

Sewers and Drains for Populous Districts. By J. W. ADAMS. Ninth edition, 81 illus. 236 pp. 8vo. (*New York, 1902*) ... ... *net* 1

Engineering Work in Public Buildings. By R. O. ALLSOP. 77 illus. ix. + 158 pp. demy 4to. (*1912*) ... ... *net* 1

Public Abattoirs, their Planning, Design and Equipment. By R. S. AYLING. 33 plates, 100 pp. demy 4to. (*1908*) ... ... *net*

Sewage Purification. By E. BAILEY-DENTON. 8 plates, 44 pp. 8vo. (*1896*) ... ...

Water Supply and Sewerage of Country Mansions and Estates. By E. BAILEY-DENTON. 76 pp. crown 8vo. (*1901*) ... ... *net*

Sewerage and Sewage Purification. By M. N. BAKER. Second edition, 144 pp. 18mo, boards. (*New York, 1905*) ... ... *net*

Sewage Irrigation by Farmers. By R. W. P. BIRCH. 8vo, sewed. (*1878*) ... ...

Digitized by Google

Sewage Disposal in the Tropics. By W. W. CLEMESHA, M.D. 24 plates, 232 pp. 8vo. (*1910*) *net* 15 0

Sanitary House Drainage, its Principles and Practice. By T. E. COLEMAN. 98 illus. 206 pp. crown 8vo. (*1896*) 6 0

Stable Sanitation and Construction. By T. E. COLEMAN. 183 illus. 226 pp. crown 8vo. (*1897*) 6 0

Public Institutions, their Engineering, Sanitary and other Appliances. By F. COLYER. 231 pp. 8vo. (*1889*) ... ... *net* 2 0

Discharge of Pipes and Culverts. By P. M. CROSTHWAITE. Large folding sheet in case *net* 2 6

A Complete and Practical Treatise on Plumbing and Sanitation: Hot Water Supply, Warming and Ventilation, Steam Cooking, Gas, Electric Light, Bells, etc., with a complete Schedule of Prices of Plumber's Work. By G. B. DAVIS and F. DYE. 2 vols. 637 illus. and 21 folding plates, 830 pp. 4to, cloth. (*1899*) *net* 1 10 0

Standard Practical Plumbing. By P. J. DAVIES.
Vol. I. Fourth edition, 768 illus. 355 pp. royal 8vo. (*1905*) ... ... *net* 7 6
Vol. II. Second edition, 953 illus. 805 pp. (*1905*) ... ... *net* 10 6
Vol. III. 313 illus. 204 pp. (*1905*) ... *net* 5 0

Conservancy, or Dry Sanitation versus Water Carriage. By J. DONKIN. 7 plates, 33 pp. 8vo, sewed. (*1906*) ... ... *net* 1 0

Sewage Disposal Works, their Design and Construction. By W. C. EASDALE. With 160 illus. 264 pp. demy 8vo. (*1910*) ... ... *net* 10 6

House Drainage and Sanitary Plumbing. By W. P. GERHARD. Tenth edition, 6 illus. 231 pp. 18mo, boards. (*New York, 1902*) ... ... *net* 2 0

Housing and Town Planning Conference. Report of Conference held by the INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS. Edited by T. COLE, *Secretary*. 30 plates, 240 pp. demy 8vo. (*1911*) ... ... *net* 10 6

Digitized by Google

Engineering Work in Towns and Cities. By E. McCULLOCH. 44 illus. 502 pp. crown 8vo. (*New York, 1908*) ... ... *net* 12

The Treatment of Septic Sewage. By G. W. RAFTER. 137 pp. 18mo, boards. (*New York, 1904*) ... ... *net* 2

Reports and Investigations on Sewer Air and Sewer Ventilation. By R. H. REEVES. 8vo, sewed. (*1894*) 1

The Law and Practice of Paving Private Street Works. By W. SPINKS. Fourth edition, 256 pp. 8vo. (*1904*) ... ... *net* 12

STRUCTURAL DESIGN.

(*See* BRIDGES AND ROOFS.)

TELEGRAPH CODES.

New Business Code. 320 pp. narrow 8vo. (Size 4¾ in. by 7¾ in. and ½ in. thick, and weight 10 oz.) (*New York, 1909*) ... ... *net* 1 1

Miners' and Smelters' Code (formerly issued as the **Master Telegraph Code**). 448 pp. 8vo, limp leather, weight 14 oz. (*New York, 1899*) *net* 2 8

Billionaire Phrase Code, containing over two million sentences coded in single words. 56 pp. 8vo, leather. (*New York, 1908*) ... ... *net* 6

WARMING AND VENTILATION.

Heat for Engineers. By C. R. DARLING. Second edition, 110 illus. 430 pp. 8vo. (FINSBURY TECHNICAL MANUAL.) (*1912*) ... ... *net* 12

Hot Water Supply. By F. DYE. Fifth edition. New impression, 48 ill. 86 pp. cr. 8vo. (*1910*) *net* 3

Digitized by Google

A Practical Treatise upon Steam Heating. By F. DYE. 129 illus. 246 pp. demy 8vo. (*1901*) *net* 10 0

Practical Treatise on Warming Buildings by Hot Water. By F. DYE. 192 illus. 319 pp. 8vo. cloth. (*1905*) ... ... *net* 8 6

Charts for Low Pressure Steam Heating. By J. H. KINEALY. Small folio. (*New York*) ... 4 6

Formulæ and Tables for Heating. By J. H. KINEALY. 18 illus. 53 pp. 8vo. (*New York, 1899*) 3 6

Centrifugal Fans. By J. H. KINEALEY. 33 illus. 206 pp. fcap. 8vo, leather. (*New York, 1905*) *net* 12 6

Mechanical Draft. By J. H. KINEALEY. 27 original tables and 13 plates, 142 pp. crown 8vo. (*New York, 1906*) ... ... *net* 8 6

Theory and Practice of Centrifugal Ventilating Machines. By D. MURGUE. 7 illus. 81 pp. 8vo. (*1883*) 5 0

Mechanics of Ventilation. By G. W. RAFTER. Second edition, 18mo, boards. (*New York, 1896*) *net* 2 0

Principles of Heating. By W. G. SNOW. 62 illus. 161 pp. 8vo. (*New York, 1907*) ... ... *net* 8 6

Furnace Heating. By W. G. SNOW. Fourth edition, 52 illus. 216 pp. 8vo. (*New York, 1909*) ... *net* 6 6

Ventilation of Buildings. By W. G. SNOW and T. NOLAN. 83 pp. 18mo, boards. (*New York, 1906*) *net* 2 0

Heating Engineers' Quantities. By W. L. WHITE and G. M. WHITE. 4 plates, 33 pp. folio. (*1910*) *net* 10 6

WATER SUPPLY.

(*See also* HYDRAULICS.)

Potable Water and Methods of Testing Impurities. By M. N. BAKER. 97 pp. 18mo, boards. (*New York, 1905*) ... ... *net* 2 0

Manual of Hydrology. By N. BEARDMORE. New impression, 18 plates, 384 pp. 8vo. (*1906*) *net* 10 6

Digitized by Google

Boiler Waters, Scale, Corrosion and Fouling. By W. W. CHRISTIE. 77 illus. 235 pp. 8vo, cloth. (*New York, 1907*) ... ... *net* 12 (

Water Softening and Purification. By H. COLLET. Second edition, 6 illus. 170 pp. crown 8vo. (*1908*) *net* 5

Treatise on Water Supply, Drainage and Sanitary Appliances of Residences. By F. COLYER. 100 pp. crown 8vo. (*1899*) ... ... *net* 1

Report on the Investigations into the Purification of the Ohio River Water at Louisville, Kentucky. By G. W. FULLER. 8 plates, 4to, cloth. (*New York, 1898*) 2 2

Purification of Public Water Supplies. By J. W. HILL. 314 pp. 8vo. (*New York, 1898*) 10

Well Boring for Water, Brine and Oil. By C. ISLER. Second edition, 105 illus. 296 pp. 8vo. (*1911*) *net* 10

Method of Measuring Liquids Flowing through Pipes by means of Meters of Small Calibre. By Prof. G. LANGE. 1 plate, 16 pp. 8vo, sewed *net* 0

On Artificial Underground Water. By G. RICHERT. 16 illus. 33 pp. 8vo, sewed. (*1900*) *net* 1

Notes on Water Supply in new Countries. By F. W. STONE. 18 plates, 42 pp. crown 8vo. (*1888*) 5

The Principles of Waterworks Engineering. By J. H. T. TUDSBERY and A. W. BRIGHTMORE. Third edition, 13 folding plates, 130 illus. 447 pp. demy 8vo. (*1905*) ... ... *net* 1 1

WORKSHOP PRACTICE.

A Handbook for Apprenticed Machinists. By O. J. BEALE. Second edition, 89 illus., 141 pp. 16mo. (*New York, 1901*) ... ... *net* 2

Practice of Hand Turning. By F. CAMPIN. Third edition, 99 illus. 307 pp. crown 8vo. (*1883*) 3

Digitized by Google

Artistic Leather Work. By E. ELLIN CARTER. 6 plates and 21 illus. in text, xii + 51 pp. crown 8vo. (*1912*) ... ... *net* 3 6

Calculation of Change Wheels for Screw Cutting on Lathes. By D. DE VRIES. 46 illus. 83 pp. 8vo. (*1908*) ... ... *net* 3 0

Milling Machines and Milling Practice. By D. DE VRIES. With 536 illus. 464 pp. medium 8vo. (*1910*) ... ... *net* 14 0

French-Polishers' Manual. By a French-Polisher. New impression, 31 pp. royal 32mo, sewed. (*1912*) ... ... *net* 0 6

Art of Copper-Smithing. By J. FULLER. Fourth edition, 483 illus. 319 pp. royal 8vo. (*New York, 1911*) ... ... *net* 12 6

Saw Filing and Management of Saws. By R. GRIMSHAW. New edition, 81 illus. 16mo. (*New York, 1906*) ... ... *net* 4 6

Paint and Colour Mixing. By A. S. JENNINGS. Fourth edition. 14 coloured plates, 190 pp. 8vo. (*1910*) ... ... *net* 5 0

The Mechanician: a Treatise on the Construction and Manipulation of Tools. By C. KNIGHT. Fifth edition, 96 plates, 397 pp. 4to. (*1897*) ... 18 0

Turner's and Fitter's Pocket Book. By J. LA NICCA. 18mo, sewed 0 6

Tables for Engineers and Mechanics, giving the values of the different trains of wheels required to produce Screws of any pitch. By LORD LINDSAY. Second edition, royal 8vo, oblong... ... ... 2 0

Screw-cutting Tables. By W. A. MARTIN. Seventh edition, royal 8vo, oblong ... ... *net* 1 0

Metal Plate Work, its Patterns and their Geometry, for the use of Tin, Iron and Zinc Plate Workers. By C. T. MILLIS. Fourth edition, 280 diagrams, 470 pp. crown 8vo. (*1906*)... ... ... 9 0

Digitized by Google

Engineers' and General Smiths' Work. The smith and forgeman's handbook of practical smithing and forging. By T. MOORE. New impression, 401 illus. 248 pp. crown 8vo. (*1912*) *net* 5 0

Modern Machine Shop Construction, equipment and management. By O. E. PERRIGO. 208 illus. 343 pp. crown 4to. (*New York, 1906*) ... *net* 21 0

Turner's Handbook on Screw-cutting, Coning, etc. By W. PRICE. New impression, fcap. 8vo. (*1912*) ... ... *net* 0 6

Introduction to Eccentric Spiral Turning. By H. C. ROBINSON. 12 plates, 23 illus. 48 pp. 8vo. (*1906*) ... ... *net* 4 6

Manual of Instruction in Hard Soldering. By H. ROWELL. Sixth edition, 7 illus. 66 pp. crown 8vo. (*New York, 1910*) ... ... *net* 3 0

Pocket Book on Boilermaking, Shipbuilding, and the Steel and Iron Trades in General. By M. J. SEXTON. Sixth edition, 85 illus. 319 pp. royal 32mo, roan, gilt edges. (*1909*) ... ... *net* 5 0

Power and its Transmission. A Practical Handbook for the Factory and Works Manager. By T. A. SMITH. 76 pp. fcap. 8vo. (*1910*) ... *net* 2 0

Spons' Mechanics' Own Book: A Manual for Handicraftsmen and Amateurs. Sixth edition, New impression, 1430 illus. 720 pp. demy 8vo. (*1912*) 6 0
Ditto ditto half French morocco ... 7 6

Spons' Workshop Receipts for Manufacturers, Mechanics and Scientific Amateurs. New and thoroughly revised edition, crown 8vo. (*1909*) .. .. *each net* 3 0

Vol. I. ACETYLENE LIGHTING *to* DRYING. 223 illus. 532 pp.
Vol. II. DYEING *to* JAPANNING. 259 illus. 540 pp.
Vol. III. JOINTING PIPES *to* PUMPS. 257 illus. 528 pp.
Vol. IV. RAINWATER SEPARATORS *to* WIRE ROPES. 321 illus. 540 pp.

Digitized by Google

Gauges at a Glance. By T. TAYLOR. Second edition, post 8vo, oblong, with tape converter. (*1900*) ... ... *net* 5 0

Simple Soldering, both Hard and Soft. By E. THATCHER. 52 illus. 76 pp. crown 8vo, limp. (S. & C. SERIES, No. 18.) (*New York, 1910*) *net* 1 6

The Modern Machinist. By J. T. USHER. Fifth edition. 257 illus. 322 pp. 8vo. (*New York, 1904*) *net* 10 6

Practical Wood Carving. By C. J. WOODSEND. 108 illus. 86 pp. 8vo. (*New York, 1897*) ... *net* 4 6

American Tool Making and Interchangeable Manufacturing. By J. W. WOODWORTH. 600 illus. 544 pp. demy 8vo. (*New York, 1905*) ... *net* 17 0

USEFUL TABLES.

Weights and Measurements of Sheet Lead. By J. ALEXANDER. 32mo, roan ... ... *net* 1 6

Tables of Parabolic Curves for the use of Railway Engineers and others. By G. T. ALLEN. Fcap. 16mo 4 0

Barlow's Tables of Squares, Cubes, Square Roots, Cube Roots and Reciprocals. Crown 8vo, leather cloth ... ... *net* 4 0

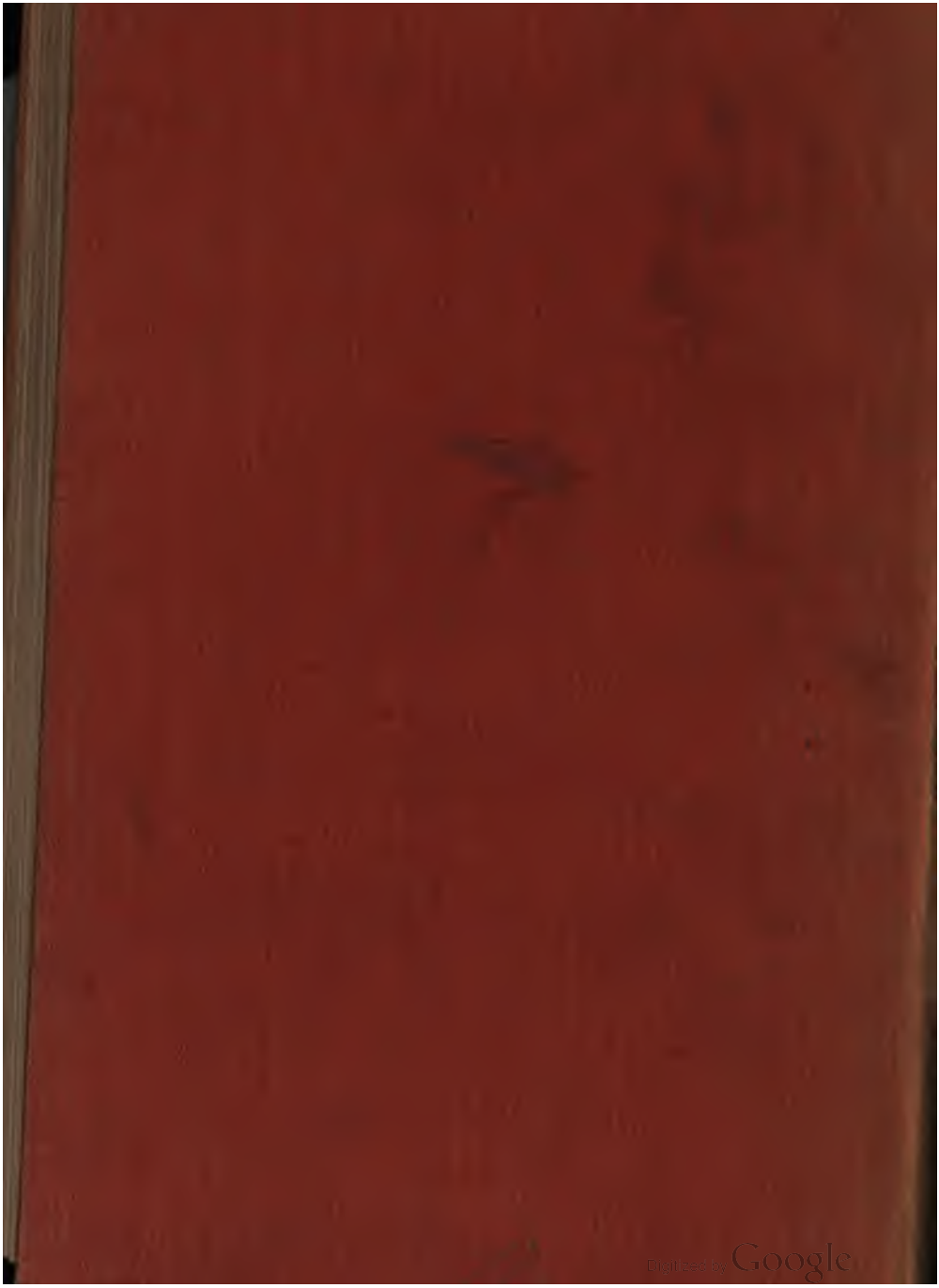
Tables of Squares. By E. E. BUCHANAN. Ninth edition, 12mo ... ... *net* 4 6

Land Area Computation made Easy. By W. CODD. Tables on sheet and explanatory pamphlet, in envelope. (*1910*) ... ... *net* 1 6

Tables for Setting out Curves from 101 to 5000 feet radius. By H. A. CUTLER and F. J. EDGE. Royal 32mo ... ... *net* 2 0

Transition Curves. By W. G. Fox. 18mo, boards. (*New York*) ... ... *net* 2 0

Digitized by Google


Digitized by Google